SCIENCE

FRIDAY, DECEMBER 1, 1911

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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

INAUGURAL ADDRESS OF THE PRESIDENT OF THE UNIVERSITY OF MINNESOTA[1]

THE ceremonies of this hour mark not so much the coming of a man as the beginning of a new phase in the life of the university. In the sweep of time most men are merged in the on-going human tide. It is wise, therefore, to look beneath the formal and the personal; to ask what this occasion really means or what it ought to mean.

Of one thing there can be no doubt. This day sees the passing of a personal leadership, although happily not the waning of that personal influence. Not all mortals are destined to be engulfed in the nameless millions of mankind. A few outstanding men can not be forgotten. "An institution," said Emerson, "is but the lengthening shadow of one man." Minnesota, in this sense, will be the lengthening shadow of Cyrus Northrop. Such unity as the university has found is due almost wholly to the fusing power of his winning and guiding personality. The university stands a living tribute to the quick sympathy, humorous tolerance, harmonizing tact, alert intelligence and moral earnestness of its president emeritus. He had to convince an often skeptical outside public; he had to moderate and adjust keen rivalries within the institution. Colleges and departments sought their own ends with only a faint glimpse of the university as a whole. As he lays down the burden of twenty-seven years he leaves the institution firmly grounded in the good will of the people, and unified by the loyalty of faculty, alumni and students. We should

[1] From the *Minnesota Alumni Weekly*.

sadly miss the meaning of this day did we fail to turn our grateful thoughts toward Cyrus Northrop and to wish him many years of serenity and happiness. Unlike Macbeth, he has

> . . . that which should accompany old age,
> As honor, love, obedience, troops of friends.

To-day the university sets its face toward a new regime. No man can take the unique place of its second president. The burden must rest on many men and women, who, as comrades, take up the task. The gains of the personal ascendency that has passed must be capitalized. Cooperation, organization, team-play, are keynotes for the coming years. An institutional period is at hand. Loyalty must look to purposes rather than to a person. Leadership will consist in carrying out policies which many have helped to formulate. Regents, faculties, alumni, students—all citizens, must see the institution more vividly as a noble trust to be administered for the common good. This spirit of cooperation can be aroused only by a compelling vision of the university seen as an organ of the higher life of the commonwealth. And this ideal must get its setting in some inspiring philosophy of the state.

Mr. H. G. Wells tells us that we, as a nation, suffer from "state blindness." "The typical American," he says, "has no 'sense of the state.' I do not mean that he is not passionately and vigorously patriotic. But I mean that he has no conception that his business activities, his private employments, are constituents in a large collective process; that they affect other people and the world forever, and can not, as he imagines, begin and end with him."

Even our friendly critic, the British ambassador, takes much the same view. "The state," declares Mr. Bryce, "is not to them (Americans), as to Germans or Frenchmen, and even to some English thinkers, an ideal moral power, charged with the duty of forming the characters and guiding the lives of its subjects. It is more like a commercial company, or, perhaps, a huge municipality created for the management of certain business in which all who reside within its bounds are interested. . . ." This individualistic, "stock company" theory of the commonwealth is neither ennobling in itself nor does it afford a sound basis for a state-supported university. We may paraphrase Mr. Joseph Chamberlin on the British Constitution, and thank God that our institutions are not logical. This philosophy would almost reduce the university to a machine for turning out persons equipped at public expense for getting a living out of the citizens who had been already taxed to train their exploiters. On this basis it is hard to see why the state should give privileges to a few at the expense of their fellows. Even the "antidote against ignorance" philosophy leaves the imagination cold. This is only a sublimated form of the policeman theory. Obviously we need some other conception of the state if we are to escape cynicism about both our social system and our public higher education.

But we can not admit that Mr. Wells and Mr. Bryce have quite made out their case. There are signs of change in the feeling of Americans toward the state. Especially in the middle and the far west do we note a keener recognition of collective interests and purposes. There is a quickened feeling of team-play, a clearer "sense of the state," which is thought of not in a merely political way, but is looked at as a social life with common aims. The people of a state have learned to work together to protect natural resources, to foster agriculture, to safeguard public health, to regulate industry and commerce, to improve the highways, to care for the defective and de-

pendent, to promote education. They have done these things sometimes through the machinery of government, sometimes through unofficial groups. All this community activity has inevitably changed the picture of the state in the minds of its citizens. The commonwealth emerges as something far nobler than a stock company run for the profit of its shareholders. It does become "an ideal moral power," a larger life in which men and women realize more fully their best selves, and to which they give something that will endure for all time. The state is coming to stand for a common life which seeks to gain ever higher levels of efficiency, justice, happiness and solidarity.

In a picture like this the state university finds both setting and sanction. It becomes an instrument of the general purpose, a training place of social servants, a counsellor of the commonwealth, a source of knowledge and idealism. It is this vision which must fascinate and control the men and women who are to-day taking up anew the responsibility for this institution. Arnold Toynbee once said: "Enthusiasm can only be aroused by two things, first, an ideal which takes the imagination by storm, and second, a definite, intelligible plan for carrying this ideal out into practice." Here is the whole philosophy of successful effort. Many an ideal comes to naught because it lacks the right means of expression. Many a well-laid plan misses the emotional energy aroused by a vision. Emerson's Oxford don whose philosophy read: "Nothing new, nothing true, and no matter" was not of those who bring things to pass. We do well to-day to catch a glimpse if we can of the university that ought to be, with the hope that it may "take our imaginations by storm" and urge us to devise "definite and intelligible" plans for action.

Francis Bacon had a dream to which we turn for a moment. In his "New Atlantis" he pictured an ideal commonwealth organized about a Solomon's House or "College of the Seven Days Works." This college "sought the knowledge of causes and secret motions of things, the enlargement of the bounds of human empire to the effecting of all things possible." The equipment of the college was complete. There were caves and mines for the study of metals, minerals and cements; towers for celestial observations; lakes for the breeding of fish; animal houses for biological experiment; orchards and gardens in which the wonders of Burbank were anticipated; parks for studying beasts and birds; kitchens for making predigested foods and health-giving drinks; operating rooms in which animal vivisection threw light on human diseases; dispensaries for medicine; laboratories for physical experiments; shops where flying machines and submarines were made; collections of minerals; sound houses, mathematical laboratories, and even a "house of the deceit of the senses" in which wonders were first wrought and then explained to a bewildered public.

But more important than the equipment was the staff. The "College of the Seven Days Works" was dedicated to research. Twelve "merchants of light" traveled the world over in search of books, apparatus, and all the latest discoveries. Three men collated these materials. Three others verified all reported experiments. Still another three known as "pioneers" or "miners" undertook new investigations, the results of which were passed on to three compilors. All discoveries that had practical utility were applied to daily life by "dowry men" or "benefactors." Not yet content, the college pushed its researches further. Three "lamps" as they

were happily called—"search-lights would be the word to-day"—projected still more penetrating inquiries which were carried out by expert "inoculators." The last step was taken by the "interpreters of nature," who sought to translate into terms of human happiness and destiny all the knowledge that their colleagues had discovered. Moreover, the "College of the Seven Days Works" did not rest content with finding truth. It put this at the service of all citizens. Were it not for its quaint form this passage might have been taken from the announcements of one of our own universities:

"Lastly we have circuits or visits of divers cities of the kingdom; where, as it cometh to pass, we do publish such new, profitable inventions as we think good, and do also declare natural divinations of diseases, plagues, swarms of hurtful creatures, scarcity, tempests, earthquakes, great inundations, comets, temperature of the air, and divers other things; and we give counsel thereupon, what the people shall do for the prevention and remedy of them."

Thus, early in the seventeenth century, we have a foreshadowing of the essential ideals of the modern university—equipment for investigation and instruction in every field of human knowledge, a staff trained and set apart as a priesthood of truth, giving themselves devotedly to their high calling, and finally a wide diffusion to all citizens of the knowledge, skill and idealism of which the university is a center and a source. We are only beginning, however, to see the need for a more effective and economical organization of research. This dream of Bacon's made more democratic, widened in scope and spirit, is yet the same as that of Huxley, who believed that universities "should be places in which thought is free from all fetters and in which all sources of knowledge and all aids to learning should be accessible to all comers without distinction of creed, or country, riches or poverty."

Let us glance rapidly at the chief things that combine in the university ideal which we would fix in our minds to-day. If the phrase "glittering generalities" dampens our ardor, we may take courage from Emerson's spirited retort, when Choate applied these words to the lines of the Declaration of Independence. "Glittering generalities!" cried the Sage of Concord, "they are blazing ubiquities!"

The picture of the state as a collective life, which seeks common ends by concerted effort, makes the state university a means of social efficiency and progress. The older individualistic theory no longer satisfies even those who put their faith in private initiative and responsibility. The university aims first of all to serve the commonwealth through individuals, not to offer personal privilege at state expense. Alma Mater is of a Spartan type, and trains her sons and daughters for work and for life. She must teach the robust gospel that "It is the one base thing to receive and not to give." She must insist that "Life is not a cup to be drained, but a measure to be filled." For the old aristocratic ideal of *noblesse oblige* she substitutes the sentiment *largesse oblige*. Acceptance of public aid may make a pauper or an ingrate or a loyal servant of the state. If tax-supported higher education is to be justified it must see itself and make the people see it as an instrument of the common life, and not an agency of privilege.

The first president of Johns Hopkins University was fond of saying that buildings are but the shell of the university; its real life lies in its men. He was proud of the fact that at the very outset an eminent physicist like Rowland used a kitchen as his laboratory. Only great men and wo-

men can make a university great. Better inspired investigators and teachers in barracks than a staff of industrious mediocrity in marble palaces. Best of all, alert, well-trained, high-minded scholars in serviceable buildings with adequate equipment. If, however, a choice must be made, it should never hesitate between men and materials. The university which is true to its ideals will draw and hold an able staff by salaries that banish petty anxiety, by freedom from drudgery, by opportunities for research and public service, and by dignifying recognition. No institution that thinks of investigators and teachers as employees is likely to secure any but the drudges of the profession.

"Enthusiasm for truth, that fanaticism of veracity," which Huxley deemed "a greater possession than much learning" is the very life of a true university. No modern "College of the Seven Days Works" can hope to keep itself alive and fruitful unless some of its members are ceaselessly engaged upon the unsolved problems. No ingenious machinery of scholarship, no mere pedantry which, as a wit has said, "never takes a step without leaving a footnote," can take the place of the genuine passion for new truth. The ideal university will not deceive itself or others by any perfunctory simulation of research. It will seek men who have the dauntless "fanaticism of veracity."

"The teaching at the ideal university," declares Birrell, "is without equivocation and without compromise. Its notes are zeal, accuracy, fullness and authority." It is hard to keep the functions of teaching and investigation in equal honor. Where research is exalted instruction is too often lightly esteemed. The "mere teacher" as the patronizing phrase runs, suffers in rank and salary and social status. In the university of our dreams the noble calling of imparting truth, stimulating reflection and kindling enthusiasm will be held in high repute. But the two types will not be too sharply contrasted, for he who teaches "with zeal, accuracy, fullness and authority" must refresh himself constantly at the sources of knowledge, while no man who pushes forward the frontiers of science can fail to impart with zest to at least a small group of followers the new truth that he has discovered. The two types must hold each other in respect and honor, and both must be held up for admiration by their colleagues.

In an ideal university students should be treated not as subjects, but as citizens of the republic of letters and science. Students have not always been in pupilage. Frederick Barbarossa conferred such powers upon the students of Bologna that they not only lorded it over the towns-folk, but we are told "reduced the latter (professors) to a position of humble deference to the very body they were called upon to instruct." To admit students to academic citizenship, however, is not to surrender to them control of the university. It is simply to emphasize their share in the community life; to fix upon them responsibility and to afford that training in corporate self-control—the selection of leaders, the creation of standards, the conformity to these—which is the very essence of democracy. The university must hark back to the mediæval ideal of a "Universitas magistrorum et studentium"—a corporation of teachers and scholars. The alumni, too, must feel themselves a part of this corporation. They do not, as at the English universities, legally control, but actually they have great power and responsibility. They will not be mere praisers of the past, and resent change because the memories of their undergraduate days have been embalmed in sentiment. On the con-

trary they will often take the initiative in new movements. They will report impressions gathered as they mingle with the people of the state; they will feel not only free, but in duty bound to make suggestions; they will make it a point to know what the university is aiming at, and will help to interpret the institution to the state. The alumni will frequent the only lobbies that the university can afford to enter, the daily converse of citizens and the agencies of publicity. And all this the alumni can do effectively only through an organization which will cooperate heartily with the other members of the university community.

If a people is not to perish mentally and spiritually it must be steadily refreshed by streams of thought and idealism. Of these the university strives to be a perennial source. Unless graduation is a mockery hundreds of men and women go forth each year to diffuse throughout the commonwealth the ideas and attitude toward life which they gained from their college training. The value of all this must be as real as it is intangible. Mathew Arnold has described the effect of such diffusion of ideas in speaking of "this knowledge turning a stream of fresh and free thought upon our stock notions and habits, which we now follow staunchly but mechanically, vainly imagining that there is a virtue in following them staunchly which makes up for the mischief of following them mechanically." If a state is to be flexible and escape the bonds of habit and custom it must be constantly revivified. In this service the university must play a leading part.

The university campus must be as wide as the boundaries of the commonwealth. The term university extension comes to us from the aristocratic centers of Cambridge and Oxford. There is about it a faint suggestion of the missionary spirit—just a hint of patronage and condescension. Of this spirit there must be no trace in a state university. Where truth is to be discovered or applied, wherever earnest citizens need organized knowledge and tested skill, there the university is on its own ground. Our ideas of time and space are changing rapidly; traditional prejudices are disappearing. The university sees as its members not only the students who resort to the chief center, but the other thousands on farms, in factories, in offices, in shops, in schoolrooms and in homes who look to it for guidance and encouragement. It is fascinating to picture the possibilities of this widening sphere of higher education as it makes its way into every corner of the state, frankly creating new needs and resourcefully meeting the consequent demands.

To find exceptional men and women, to train them for service, to fit them for leadership, to fill them with zeal for truth and justice, is the one great aim of the university. "The mind which keeps the mass in motion," said Godkin, "would most probably, if we could lay bare the secret of national vigor, be found in the possession of a very small proportion of the people, though not in any class in particular, neither among the rich nor the poor, the learned nor the simple, capitalists nor laborers. . . ." Society must see to it that this vivifying mind comes to its own. Aristocracy draws its leadership from a caste; democracy from every group of the people. The state university should be accessible to all who give unusual promise, whether they have private means or not. Cecil Rhodes left a fortune to make Oxford for all time a Mecca for successive scores of American youth. Surely, large-minded men of wealth, local communities, some time, perhaps the state itself, will endow scholarships which will draw to our uni-

versities exceptional young men and women from every county of the commonwealth. This would be a statesman-like, far-seeing thing to do. The experience of Scotland and England for three centuries has its lesson. The hardy north has contributed to the United Kingdom men well beyond its per capita quota. This outstripping of England is to be credited largely to the democratic education of Scotland in contrast with the caste system of England. Huxley in an address at Aberdeen, thus pictures the two types: After speaking in tolerant vein of "The host of pleasant, manly, well-bred young gentlemen who do a little learning and much boating by Cam and Isis," he goes on to say, "when I turn from this picture to the no less real vision of many a brave and frugal Scotch boy spending his summer in hard manual labor that he may have the privilege of wending his way in autumn to this university with a bag of oatmeal, ten pounds in his pocket and his own stout heart to depend on through the northern winter; not bent on seeking

'the bubble reputation at the cannon's mouth,'

but determined to wring knowledge from the hard hands of penury; when I see him win through all such outward obstacles to positions of wide usefulness and well-earned fame, I can not but think that in essence Aberdeen has departed but little from the primitive intentions of the founders of universities." The individual side of the picture has its appeal, but its social aspect is after all more significant. From the university towers the search-lights must be ever sweeping country-side, village, town and city for the "minds which keep the mass in motion."

Standards of truth, skill, taste, efficiency are the capitalized experience of society, essential to stability and progress. Of these standards the university is one of the guardians. To these, come what may, it must be true. No sympathy for individuals, no pressure of influence, no fear of retaliation, no desire for numbers must weaken fidelity to standards. Freedom of research, freedom of teaching, high ideals of productive scholarship and of professional integrity, conscientious and fearless appraisal of students' work are of vital concern to the university and to the state it serves. To help to refine and raise these standards, to adjust them more nicely to social needs, to fix these values in public opinion, is a duty of the ideal university.

In the striking phrase of President Van Hise, the university must aim at being the "expert adviser of the state." How stirring the thought of a well organized and efficiently manned center of knowledge, skill and wisdom, holding itself at the disposal of every constructive interest and activity of the community, and ready to concentrate upon their problems the sifted experience of all the world. In this responsiveness the true university expresses its purpose and spirit. It is a bureau of information, the stored memory of civilization, an alert investigator of new facts; it is a friendly and at the same time a disinterested counsellor. It is pathetic to see men, isolated from the wisdom of the centuries and of their own times, hopefully assailing the ever recurring problems of life. The waste of effort, the futility of duplicating errors, cry out for aid. The opportunities for service multiply with each year. We are coming to realize that good farming is no longer a robbing, but a recompensing of the soil; that it costs as much to plant bad seed as good; that sometimes cows are pensioners instead of producers; that bad highways are the heaviest road tax; that cheap schools are the most expensive; that public health is

national capital; that juvenile delinquency comes less from depravity than from deprivation; that industrial accidents are not lawyers' perquisites, but costs of production; that all idleness is not due to indolence; that social legislation is not an amiable avocation, but an exacting profession; that municipal government should not be so skilfully designed to prevent bad men from doing harm, that it keeps honest and efficient men from doing good; that the United States must trust less to a "manifest destiny" and more to a constructive purpose. In these changes of theory and method there is need of accurate knowledge, carefully interpreted experiment and authoritative advice. If the university is true to its mission it will put all of its resources and its trained experts at the service of the community. Amid the conflicts and rivalries of many interests, parties, sects, sections, professions, social groups, the university must never waver from the position of an unimpassioned, unprejudiced seeker for the truth, all of it and that alone. This responsibility is not to be assumed lightly. Mistakes are costly in public confidence. Eternal vigilance is the price of prestige. The discomfiture of the expert gives joy to the average citizen. The ideal university must, therefore, be true to the most rigorous laws of scientific method if the institution is to gain and hold its place as the "expert adviser of the state."

By virtue of its rôle as a public servant the university is under peculiar obligation to cooperate with all the other agencies of the state, its commissions, boards and institutions. These should turn naturally to the university for expert advice and for trained functionaries. So, too, the many private associations, charity organization societies, playground associations, social settlements, juvenile protective leagues, public art societies, study clubs, and other similar groups should find the university ready to meet them more than half way. With the educational forces of the state the university should be in close terms of sympathy and effective team-play. The elementary schools are not to be deemed beneath the notice of higher education. On the contrary, the university should be a leader in studying painstakingly the problems of the common schools. It can not afford to be indifferent to the broad base of the educational pyramid. That the university is vitally interested in the high schools says itself. Yet this interest must not take the form of either patronage or dictation. The days for these things have passed. With the high schools in charge of college-bred men and women condescension is intolerable. Since the high school, in the west at least, is recognized as the "people's college," to assign it to the rôle of an obedient preparatory school is out of the question. Nevertheless, the high school needs the university as a friend and counsellor. The relations between the high schools and the university should become closer through the association of all that are interested in the same subjects of instruction, by periodic conferences at the university, by visits not only of college teachers to high schools, but of high school instructors to college class-rooms, by joint committees which shall study the educational system as a whole. To the normal schools the university has held an anomalous relation. These institutions were founded to prepare teachers for the common schools. Of late college training has become virtually a prerequisite for high school appointments. The normal schools have been attended by growing numbers who expect to go on to college. At the same time the demand for training in the natural sciences, modern psychology, in-

dustrial arts, home economics (just now agriculture is seeking admission), has compelled the schools to widen their curricula and strengthen their teaching force. In these circumstances the idea of some readjustment inevitably arises. The university is in duty bound to confer with the normal schools and to seek a wise solution for the problem. So, too, with the private colleges of the state, the university must be on the friendliest terms. Close relations between these colleges and the professional schools of the university should be established, so that there may be no semblance of compulsion as to the place of collegiate preparation. The true unity of the state educational system consists not in official machinery, but in a spirit of mutual understanding, respect and good will among the men and women to whom the educational interests of the state are entrusted.

The spirit of cooperation is more palpable than another influence which should radiate from the university. And that is the scientific spirit. This is an attitude of open-mindedness toward all truth, a determination to get all the essential facts before forming a judgment, a willingness to abandon a position when it is no longer intellectually tenable; a tolerance for the opinions of others which are to be accounted for rather than derided or denounced. This spirit is free from acrimony, blind partisanship and prejudice. In a world of eager activity, of personal ambition, of keen group rivalry, of clashing interests, with all the consequent bitterness and misrepresentation, it is the duty of the university both in its methods and in its personnel to set a shining example of that calm, fair-minded, tolerant spirit that seeks the truth which makes men free.

"The benefits the country derives from the university," wrote Mr. Godkin thirty years ago, "consist mainly in the refining and elevating influences they create, in the taste for study and research which they diffuse, in the social and political ideals which they frame and hold up for admiration, in the confidence in the power of knowledge which they indirectly spread among the people, and in the small though steady contribution which they make to the reverence for 'things not seen' in which the soul of the state may be said to lie and without which it is nothing better than a factory or an insurance company." There is no mention in all this of direct utility through professional training or industrial efficiency. The editor of the *Nation* would, perhaps, have repudiated these things as Mr. Birrell did in an address he gave to a body of London students. "The education it (the university) essays to give will not teach you to outgabble your neighbor in the law courts, to unseat him in his constituency or undersell him in the market-place. Gentlemen, be it understood once for all, those things do not require a university education. The commonwealth may safely leave these to be performed by the combination of the three primary forces, ambition, necessity and greed." Of our own Cornell University in its early years the author of "Culture and Anarchy" wrote: It "seems to rest on a misconception of what culture truly is, and to be calculated to produce miners, or engineers, or architects, not sweetness and light." Here are pertinent questions. Can the state safely leave to "ambition, necessity and greed" the training of its professional men and its leaders? Has it no place for culture, for what Arnold read into Swift's phrase "sweetness and light"? In its eagerness for valuable knowledge and practical efficiency is the university neglecting "the things that are more excellent"? Is it losing reverence for "things unseen"? Of this there is always

danger. Action and tangible results that appeal to men so strongly are often at odds with reflection and spiritual values. The ideal university must not forget that material efficiency is only a means to ends—a finer type of personality, a more just and ennobling social order. The university aims at training, not skilled exploiters, but men and women who shall first of all be high-minded citizens with a loyal "sense of the state," who shall exemplify the scientific spirit, bear themselves gallantly in life's struggles, show themselves possessed of satisfying mental resources, and prove faithful to the highest standards.

Men and women of this sort do not issue from a place given over wholly to utility and material interests. There must be a controlling, pervasive spirit of service, a desire for "a harmonious expansion for *all* the powers which make the beauty and worth of human nature," and a real appreciation of life's deeper meaning. The university must help men to answer Kant's three questions, the questions of science, of morality, and of religion: "What can I do? What ought I to do? What may I hope for?" True, the state university can have no official theology and no ecclesiastical affiliations. But it may have a spirit of reverence for the mysteries of life; it may cultivate that essential religion which exalts the things of the human mind and spirit over things physical and which reads back of the material world a purpose and a destiny. "The state," said Arnold, "is of the religion of all of its citizens, without the fanaticism of any of them." Bacon's "College of the Seven Days Works" was a research institution, but it did not forget that it was concerned with only certain aspects of a vast university. "We have," said one of the staff, "hymns and services of laud and thanks to God for His marvelous works, and forms of prayer imploring His aid and blessing for the illumination of our labors and the turning of them unto good and holy uses."

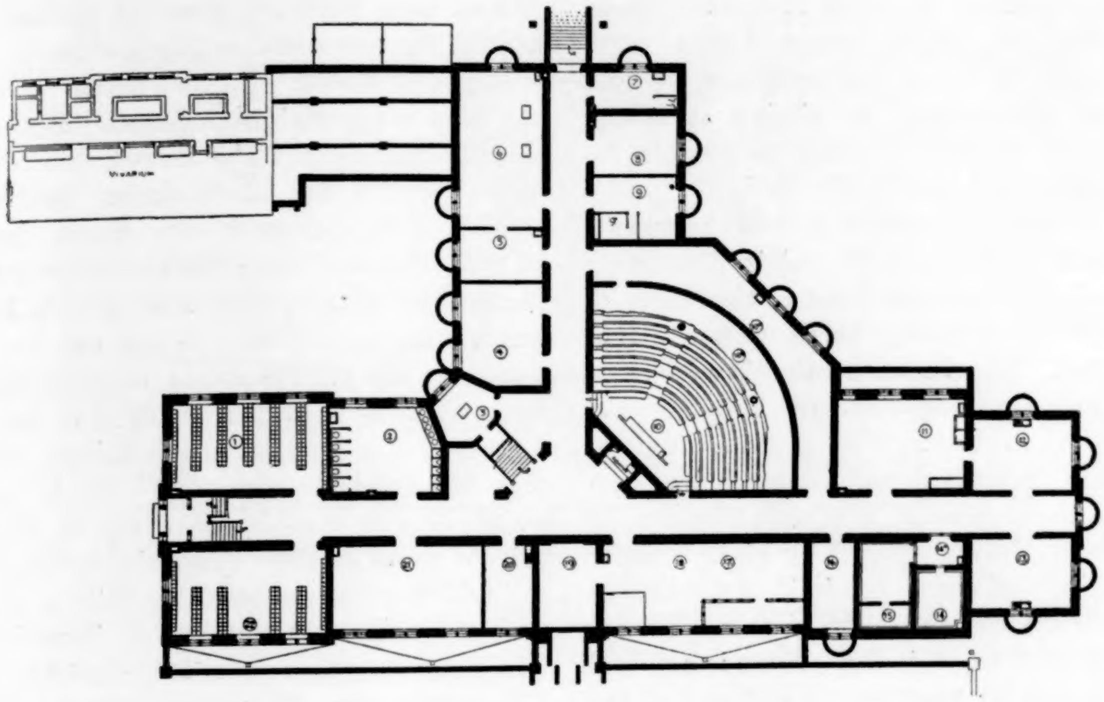
We have caught glimpses of the university ideal. May this, as the years pass, grow ever clearer, nobler, more inspiring. May it take our "imaginations by storm" not as an evanescent emotion, but as a persistent vision. We remember Toynbee's words, "a definite intelligible plan for carrying that ideal out into practise." It is to the many details of this plan that as colleagues we are to address ourselves. May we take up this great task with a solemn sense of what it means. We must not deceive ourselves. We advance to no easy triumphs. We must cherish no millenial dreams. We must have faith that good-will guided by wisdom will in the end bring our vision to pass. Let us then with sober judgment and steady courage pledge anew our loyalty to the ideals of the university, to the people of the state and to that republic of science, letters and the arts which knows no national boundaries. May each of us take to heart the counsel of Goethe:

> What each day needs, that shalt thou ask;
> Each day will set its proper task.
> Give others' work just share of praise;
> Not of thine own the merits raise;
> Beware no fellow man thou hate;
> And so in God's hands leave thy fate.

George E. Vincent

THE NEW ZOOLOGICAL LABORATORY OF THE UNIVERSITY OF PENNSYLVANIA

In devising and planning this laboratory to fill the needs for many years to come of zoological study at the University of Pennsylvania, zoology has been construed in its broadest sense, as the science of animal life. All, therefore, it was considered, should be included that would allow of the prosecution of study in any branch of this great and most important subject; and this object we have



Basement

The First Floor

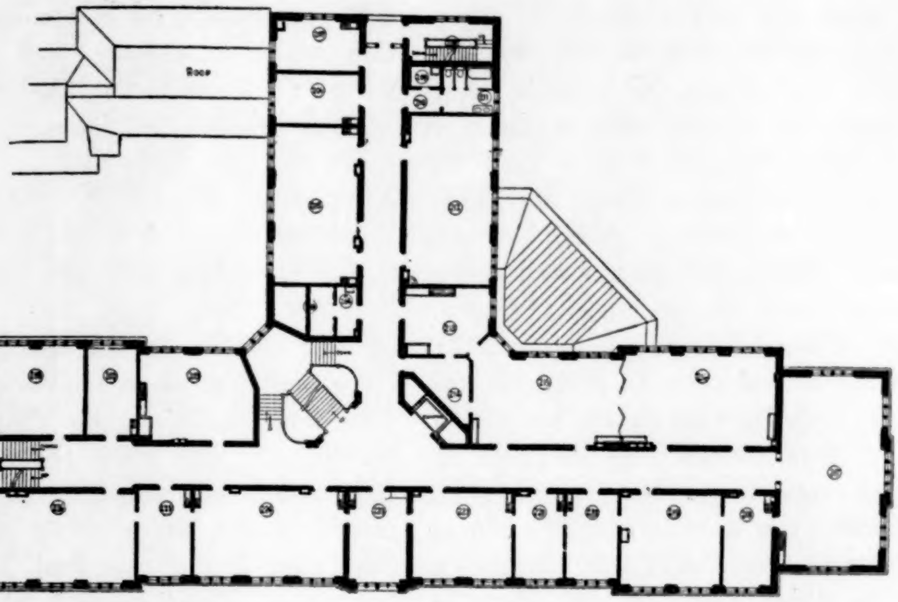
tried to fulfill, so far as we understand present needs and could foresee future ones. Great praise is due to the architects, Messrs. Cope and Stewardson, for aiming at utility first, and for meeting as closely as possible the requirements planned by the staff.

The building comprises a full basement, with three stories above it, and is thoroughly fire-proof. The general form is that of a T, the longest wing facing north with a length of 216 feet. The shorter south wing connects at the east with the vivarium building that was erected in 1900. This gives a minimal amount of hall space and all corridors, even those of the basement, are amply lighted by windows at their ends and by glass interior doors. The main entrance is in the center of the north façade, and close to this main entrance is the main stairway. There is a second entrance and stairway at the east end of the main wing, a special freight entrance to the basement at the south end, and near the last an exterior fire escape. The type of architecture is early English Renaissance; the walls are of sand-moulded red brick, in a variety of shades, laid Flemish bond. Base courses, cornices and window-sill levels are of gray Indiana limestone; the corners of the building are built of this stone, and doorways and windows framed with it. All windows are exceptionally large and extend nearly to the ceilings; those on the north front have in each sash two panes of glass separated by a half-inch air space, so as to reduce the cost of heating.

Above the third-story windows of the east end of the main wing are inscribed the names of Cope and Leidy, the great naturalists of Philadelphia; and on its north face the names of Lamarck, Darwin, Huxley, Claude Bernard, Johannes Mueller, Harvey, Aristotle, Malpighi, Von Baer, Schwann, Réaumur, Cuvier, Linnæus and Ray.

All floorings are cement; this is covered with terrazza in the corridors, with linoleum in the library and lecture rooms, and with maple in all private rooms and laboratories—the cement being left in the breeding and preparation rooms. Maple flooring is more durable than linoleum, does not splinter, and with age grows continuously harder.

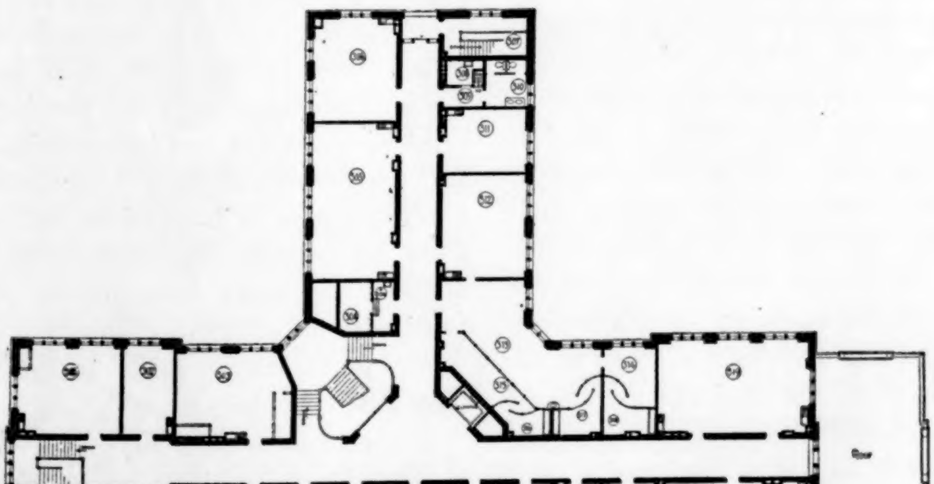
The unit system of construction of rooms has been fairly rigidly followed. Rooms are only 20 feet deep. The largest laboratories, each intended for 24 students, the largest number a demonstrator can direct, measure 20×36 feet, and have three windows; a few smaller laboratories, each intended for 16 students, measure each 20×24 feet and have two windows; the private rooms for investigators range from 20×11 feet to 20×14 feet and have each one window. Each private room is then one third the size of a large laboratory unit. It was considered wisest to keep all private rooms of these dimensions rather than to build larger ones, so as to fully accommodate a considerable number of investigators. The only exception is a large private room (No. 301) for physiology, 20×24 feet. These private rooms for the staff and investigators are situated mostly on the north; there are two of them (Nos. 113, 116) on the first floor, six (Nos. 207, 218, 220, 221, 223, 225) on the second and seven (Nos. 301, 322–328) on the third floor, a total of fifteen. Each of these rooms has a window table two feet wide extending the whole width of the room, supported rigidly on iron brackets fitting into the wall; and a sink in one corner next the hallway. In addition there is a larger room (No. 320) on the third floor to accommodate several workers at once, with a continuous window table on two sides. In each full-sized laboratory there are three working tables, each 4×13 feet, accommodating eight students and placed at right angles to the windows—an arrangement that prevents the demonstrator from interfering with the light of any student; in each table are drawers, and lockers each large enough for a compound and a dissecting microscope and dissecting trays. The inner side of each locker door has two shelves for bottles, and each microscope and its parts bear the same number as the locker. Each student receives a table area of two feet by three and a quarter, one locker and two drawers. In certain laboratories, as those for histology and cytology, these tables contain



Second Floor Plan

gas and electric outlets, and those for physiology and protozoology contain also sinks. The only exception from this general type of large laboratory table are certain special ones for anatomy which are made considerably higher and in smaller units suitable for individual students. Every laboratory has a slate blackboard, 3×12 feet, directly facing the windows, and a sink in each corner of the hallway.

There are two lecture rooms. The large auditorium (No. 10) is reached by the students from the first floor, by the speaker from the basement, and has almost the height of the basement and first floor; it is placed at the junction of the main with the south wing,



Third Floor Plan

utilizing a space not well adapted for other purposes. This has 327 seats without writing arms, with only a moderate rise in their tiers, and four aisles; beneath the large skylight is a system of vertical shutters that may be turned horizontal, so as to exclude the light, by the revolution of a wheel placed beneath the blackboard. The smooth plaster wall above the blackboard furnishes a lantern screen, 11 $\times$ 11 feet. A small lecture room (No. 212) is placed on the second floor, to accommodate sixty students, with separate chairs fitted with writing arms. But lectures may be given in any laboratory room, for all have blackboards.

Nearly opposite the smaller lecture room is a room for charts (No. 206); this contains a metal rack on which Leuckart and Deyrolle charts are hung vertically by hooks.

The library (No. 111) is at the west end of the first floor, and measures 24 $\times$ 44 feet. It is fitted with five double-range metal stacks, and a folio stack; one end of it is a reading space. Adjoining it is a librarian's room (No. 110). The library is to be entered from the librarian's room, so as to prevent ingress of dust from the hallway.

No large museum rooms were planned, only a synoptical museum and rooms for the storage of anatomical collections. It was not thought wise to duplicate in any way the exhibition collections of the museums of Philadelphia, but to make the building strictly a working laboratory.

For the elementary courses in general zoology, four laboratories are provided on the first floor, accommodating ninety-six students at one time. The laboratories for general zoology (Nos. 104, 114, 115, 117) and the auditorium (No. 111) and synoptical museum (No. 101) which are auxiliary to this course, are all placed on the first floor so as to segregate the majority of the students there, and to avoid noise on the stairways. Only as the students proceed to more advanced courses will they pass to the other floors, and thereby ascend the heights of learning. It was not thought necessary to provide any special preparation rooms for the course in general zoology, because each laboratory has its own sinks and preparation tables, besides a demonstration table on castors that may be readily moved from one room into another; there are no sills beneath the doors.

On the first floor, also, is a laboratory for entomology (No. 112), and opposite it one (109) for advanced work on this subject.

For vertebrate anatomy there are two laboratories (Nos. 215, 216) for elementary courses on the second floor, each with two large sinks; these are separated by a sliding accordion partition, so that they may be thrown into one when necessary. Adjoining these is a small room (No. 214) for charts and models and a preparator's room (No. 213); the latter has a chemical hood and a very large sink. Contiguous is also a storage museum (No. 217) with a large wall case for larger mounted skeletons, and a series of vertical cases provided with interchangeable trays and drawers and with lift-off wooden doors fitting almost dust-proof; the latter cases are for alcoholic and other specimens. Another part of the anatomical equipment are two storage rooms (Nos. 12, 13) in the basement for rough collections, and a special preparation room (No. 11) communicating with these; the latter has a specially designed hood for maceration and boiling of skeletons, a large slate table with running water, a heating and drying table, a sink large enough to contain the body of a horse, and an overhead trolley track for the carriage of large objects.

For elementary work in histology and embryology there are two laboratories (Nos. 205, 224) on the second floor. For more advanced courses, especially in cytology and embryology there are two smaller laboratories (Nos. 222, 219) on the same floor, one of these being fitted with an aquarium table.

For protozoology there is one laboratory (No. 226) for elementary work, and opposite it a culture room (No. 201) with southeast exposure provided with an aquarium table.

All these courses demanding much microscopical work are close together and convenient to the special room (No. 202) for paraffine baths and sterilizers, and to the reagent room (No. 203), which has a chemical hood

and is for the housing of all general glassware and reagents.

On the third floor at the east end is the section for physiology. This comprises a large private room (No. 301) with a hood, rigid table for a motor and chemical table; a laboratory (No. 330) for elementary work, with a hood; a glassware and apparatus room (No. 302); a room (No. 329) for motors; and a biochemical laboratory (No. 303) completely outfitted with a large hood and two chemical tables, and enclosing a balance room partitioned off by glass. For the most precise weighing there is a small room (No. 3) in the basement with a built-in pier. A laboratory (No. 319) for animal behavior is placed on the third floor. For the use of both these subjects there are two rooms painted dull black for experiments on reactions to light; one (No. 313) of these is on the third floor, intended especially for the study of the effects of sunlight, and the second (No. 6) considerably larger, is in the basement and provided with built-in piers for the placing of delicate physical apparatus, and with an anteroom (No. 5) for light generators.

Of other general equipment the following may be briefly described:

For photography there is a dark room (No. 9) in the basement for the special use of students. The main space for this purpose, however, is a large room (No. 313) on the third floor, with a skylight over a portion of it, communicating with which are three dark rooms (Nos. 315, 316, 317), one of them especially large for work with the ultra-violet apparatus; and adjoining is a room (No. 314) for microphotography, also with a dark room (No. 318).

In the basement is a machine shop (No. 21) well equipped with metal- and wood-working machinery (lathes and drill presses) for the repair and making of apparatus.

For breeding and other experimental work there are considerable facilities. Within the new building are no aquaria provided beyond special aquarium tables in two rooms. The old vivarium is now devoted almost entirely to aquaria, is well equipped with tanks and pools for fresh water, and with a smaller section for salt water; two new shallow floor pools have been added to it. The wing connecting the vivarium with the new laboratory consists of a keeper's room (No. 120) and of two breeding rooms (Nos. 118, 119) for mammals, the latter with outside wire-enclosed runs; there is another wire enclosure south of the vivarium; the hallway leading to the mammal rooms is closed off from the main south corridor by a special door so as to exclude odors. This mammal wing is raised well above the ground level so as to insure dryness, and is well ventilated.

The large room (No. 105) at the southeast corner of the south wing, immediately adjointhe mammal wing, is also designed for breeding purposes, particularly for insects, and so is room No. 109 on the same floor. In the basement is a room (No. 20) on the north side for the incubation of hens' eggs. On the third floor are three large rooms (Nos. 305, 306, 311) in the south wing for the future extension of breeding facilities. All these various breeding rooms have drained cement floors. On the east side is a ground area enclosed on three sides by the walls of the building, and it is planned to screen this off for outdoor breeding.

There are four constant temperature rooms. Room No. 15 of the basement is for the cold storage of anatomical material, to be kept at a temperature ranging from 28° to 32° F. Separated from it by a partition is room No. 15A, which measures 5×12 feet, and is for cold constant temperature of from 14° to 32° F. Room No. 16 is for the cooling machinery and room No. 14 for the large brine tank. On the second floor is room No. 204 for constant body temperature, to be heated by the radiation from a gas stove. Room No. 304, on the third floor, is designed to be set constant at any temperature between 32° and 98° F.; it allows the admission of sunlight through the roof, the light passing through a basin of running water. All rooms and anterooms are thoroughly insulated with nonpareil corkboard and provided with Stevenson refrigerator doors. It is designed in each room to keep

the temperature constant within $\frac{1}{2}°$ F. of the point selected. The refrigeration is kept independent of the ventilation; the air for ventilation is cooled in the anterooms to the temperature of the rooms to which it is to be admitted. This matter of ventilation is one of the most difficult, but absolutely necessary when it is intended to keep living animals for long periods. The refrigeration is by the circulation of brine in coils, automatically controlled by thermostats. For the cooling of the brine there are two ammonia-compressors of the vertical single-acting type; one is large enough to operate the entire plant under all conditions; the second with a capacity of half of that of the first. Within constant-temperature rooms where living animals are to be kept there are no ammonia pipes, so that there can be no leakage of ammonia in the rooms.

The direct steam heating is from a central power station, as is also the electric power. All lighting is by electricity. In the basement is the plant (Nos. 17, 18, 19) for ventilation by filtered air, and this is subdivided into systems so that different parts of the building may be ventilated independently of each other. All ventilation conduits are placed within the walls lining the corridors. Steam, gas and water pipes are all exposed, and so are the rain conductors which are inside the building. The sinks, which are in nearly every room of the building, are of soapstone with an ash drain board at one end; most of the sinks measure one and a half by two feet, but certain special sinks for anatomy are much larger; one of the latter is 3 feet deep and 8 feet long. Each bibb has an extra small cock for the attachment of rubber tubing. Bunsen burners are attached to gas outlets by flexible wire tubing.

All tables have birch tops, ebonized. All wall cases are of oak with glass doors, and all the furniture is master-keyed. Drawers and trays of all standard wall cases are interchangeable. The general type of wall case is four feet wide; the upper part is provided with glass doors and shelves, the lower, deeper part with wooden doors and shallow drawers. The usual type of preparation table has a top measuring $1\frac{3}{4} \times 5$ feet, and is of a convenient size to move. Beneath the built-in window tables there are no drawers, so that one may work at any part of them. All chemical hoods have wooden frames in order that the glass may be readily replaced when broken.

The office room (No. 102) is on the first floor between these two entrances that are most used; it is occupied by the stenographer, who also acts as telephone central and keeps student records. There is an intercommunicating telephone system with twelve stations, at any of which a person may call up any station independently of the telephone central. A room (No. 103) for the janitor is placed near the main entrance. For freight there is a room (No. 8) in the basement and also a large space (No. 10A) beneath the seats of the auditorium.

For the use of the men students are two locker rooms in the basement, with vertical lockers of expanded metal, adjoining which is a large lavatory (No. 2) and a smoking room (No. 4). There is a separate toilet for janitors (No. 7). For women is provided a locker and sitting room (No. 108) on the first floor, with lavatory (No. 107) contiguous. On the second and third floors are other toilet rooms (Nos. 211, 310), that of the second floor provided with a bath for the convenience of any investigator who chooses to reside in the building.

The whole building has been made as elastic as possible so as to provide for future needs. Partitions between rooms are of terra cotta and may be easily removed; it will prove cheaper to tear down partitions so as to make larger rooms when necessary than to have large rooms at the start and later erect partitions in them.

Thomas H. Montgomery, Jr.
University of Pennsylvania

THE CHEMIST AS A CONSERVATIONIST

It is remarkable, if one has not given the matter serious consideration, to what extent the chemist is interested and concerned in the conservation movement, that has recently been agitated in this country. This was especially

emphasized by the papers that were read and the discussions presented at the recent meeting of the third National Conservational Congress in Kansas City. It was intended that this should be especially a "Soil Conservation" meeting, and as such great prominence was given to this topic.

Ever since the settlement of this country, its abundant soil resources have been drawn upon, or there has been, as A. P. Grout puts it, a literal "Rape of the Soil." The fertility was earliest exhausted on the thin soils of the eastern states, but it is only a matter of time when the abundant cropping will tell all over the country; and in fact the important mineral constituents of the soil will be practically exhausted. We are not a people who can sit down and wait for nature, through the slow decomposition processes and through vegetation, to again render the soil fertile. The chemist must come forward and show how cheap phosphorus, cheap potash and cheap nitrogen can be obtained. The physical character of the soil must be studied in order to secure better cultivation and greater adaptability of crops to environment.

The water supplies of the country should be more thoroughly understood. Not only must the engineer utilize the pent-up mountain torrents for producing power or for irrigation, but the surface and ground waters must also be used as domestic and municipal supplies. The quality of this water should be known, and the conditions favorable to maintaining its purity are to be investigated in the laboratory. Again, with the growing manufacturing industries, the industrial waste has to be taken care of in some way so that the health of the people be conserved, and the streams remain unpolluted. If the sewage is allowed to enter the streams, it must be so purified that it is no longer sewage. Water-softening plants are now deemed a necessity whenever the water is not soft enough for laundry and domestic use.

We realize that our wood supply is rapidly wasting away, and there is need of care to prevent waste not only in the cutting of timber for lumber purposes, and in the precautions against forest fires, but also in the utilization of the immense quantities of waste in smaller limbs, roots and slabs. This, J. B. White asserts, is often as much as 60 per cent. of the tree. Here is an almost inexhaustible supply of material which, as has been shown by G. B. Frankforter and other chemists, may be utilized in the manufacture of charcoal, acetic acid, wood alcohol, tar, resin oil, acetone, gas and turpentine. The sawdust chokes the streams and kills the fish; use it as a fuel or for the manufacture of chemicals.

In this same connection it is worth while to notice that the need for so much wood in construction has gradually been decreased by using Portland cement. The chemist has tested the limestones and shale, and can tell where cement can be made at a profit. He studies the market, the supply of raw material and the cost of transportation of fuel for a given locality.

A few years ago our people went on the principle that the supply of natural gas as fuel was practically inexhaustible, but now that they have begun to realize their error from the shortage in many states, they are trying to make the gas last as long as possible. Other fuels are investigated by the chemist and we are familiar with the use of "process-gas" and petroleum burners. The "slack" from the mines is molded into "briquettes," and used as domestic fuel.

That the "live-stock farm" will do much towards preserving the fertility of the soil is the belief of F. B. Mumford. It seems very reasonable that if the farmer returns to the soil the barnyard manure from his stock, the more important chemical ingredients will be retained. If, on the other hand, he sells his crops, such as corn, wheat and hay, the land will soon show signs of depletion.

In the utilization of by-products no one is more active than the chemist. He shows how all the waste material may be utilized at the packing house, how the whey from cheese manufacture may be used to make milk sugar; how the casein may be made into buttons or dried and used in the arts; how the cotton seed may be utilized for making oil, and for a stock food; how peanut oil may be used to take the

place of lard; how the once despised coal tar may be made the basis for the manufacture of dyes and scores of organic chemicals, and how the waste lye of the soap-boiler may be used for the manufacture of glycerine.

In the preservation of the life and health of the children, who is more concerned and active than the expert who studies the composition of the air they breathe in the school room, and of the water they drink, at home? What more efficient help can be afforded to the people at large than that given by the various pure-food laboratories, both state and national? The foremost object of these laboratories is to safeguard the public against impure and injurious foods, and to protect them from the frauds of mislabeling and misbranding.

In the department of domestic science in the schools and colleges, much of the instruction is in these same lines, *i. e.*, to teach what is good food, wholesome surroundings, pure air, a sanitary dwelling; in all of this and similar work the chemist is continually giving his help, and by his investigations advancing the well-being of the community, so as to make life more worth the living.

E. H. S. Bailey

CYRUS G. PRINGLE

Cyrus G. Pringle was born in Charlotte, Vermont, May 6, 1838, and died in Burlington, Vermont, May 25, 1911. At an early stage his studies at the University of Vermont were interrupted by the death of his father and he was compelled to return to the home farm to assist his mother in the support of the family.

Always interested in botany and horticulture, he declared in 1869, "My chief study shall be the adaptation of our beautiful Valley of Lake Champlain to horticultural pursuits"—the development of his native valley was the ambition of his life.

He began with a comparative study of the climatic conditions of the Champlain valley and of the adjoining horticultural areas. He followed this study by introducing plants from more southern areas and testing them under Vermont conditions. Finally, he attempted to improve plants which could be grown under these conditions, by breeding and selection. It was in this field that he attained his greatest success.

Dr. Pringle laid a broad foundation for his work. He visited nearly all persons in this country who were engaged in the improvement of plants by breeding and selection, studying their methods and results. February 24, 1869, he imported a copy of Lecog's work on hybridization. While waiting at the mill for his turn to have his wheat ground, he learned to read French and pursued the study of Lecog's work.

As might be expected from such a man, he soon gained a wonderful insight into the nature of plants and success crowned his efforts. In a short time his farm became well known both to scientists interested in the laws of plant breeding and to horticulturists and seedmen seeking new varieties. Among his early friends and visitors was Luther Burbank.

Dr. Pringle did not limit his work to any one line of plants, but included all kinds, both useful and ornamental, which might help to develop his native state. Some idea of the scale on which he worked may be gained by a study of his early records. These show that he set out 1,500 apple and 600 pear stocks for an experiment in adaptation; that he was carrying on breeding experiments with over 25 species of plants, including cereals, potatoes, grapes, pears, plums, apples, cherries, a variety of ornamental plants and others; and that in every case he was working with very large numbers of individuals. His collection of bulbs of ornamental plants was the largest in point of variety, not only in the United States, but in the world.

He was able to originate and place on the market three potatoes of special merit. These were the Snowflake, the Alpha and the Ruby. The first attained great popularity and was sold at a large figure to a New York house. This house paid him as high as $1,000 per pound for potato seed. In cereals he originated the Defiance Wheat, the Champlain Wheat and Hulless Oat. The first of these "has been for years the standard wheat for

irrigated sections in Colorado and adjoining states."

Only about ten years was devoted to the work outlined above. In that brief period he accomplished much. His farm was an experiment station teeming with possibilities when adverse circumstances caused him to give up this work. In a short time he turned his attention entirely to collecting and he became a botanical explorer. He began his collections in Vermont, but gradually extended his field to include the lower St. Lawrence, the Pacific slope, the southwestern states and territories, and finally Mexico.

Early in his career as a botanical collector of rare ferns in the Green mountains, he became acquainted with Professor Asa Gray, who later styled him "the prince of botanical collectors." Dr. Gray was engaged at that time upon his "Synoptical Flora of North America" and he assigned to Dr. Pringle the investigation of the flora of Mexico, "charging him, as they sat with a map spread before them, to ascertain especially the southern limit of distribution of species found in the United States and also to ascertain what related species might be indigenous in the adjacent regions of Mexico."

His first trip to Mexico was begun February 25, 1885. He was cordially received by the Mexican government officials, who gave him every possible assistance in his work, including letters to subordinates, special police protection when necessary, railroad passes for himself and assistants, etc. During the following twenty-six years he made thirty-nine trips to Mexico, sometimes bringing home large collections, sometimes returning emptyhanded on account of sickness either of himself or his assistant. During this period he was able to travel over large areas and collect from many localities. He collected the desert flora of the arid interior plains of the great northern states; the alpine plants from the mountains capped with perpetual snow; the rich flora of the tropical jungles along the coast and lowlands.

As official collector for Harvard and the National Museum, he made for each institution a set of all his collections in addition to the set which he made for his own herbarium. However, he did not confine himself to these three sets, but attempted in every case to collect 60 extra sets for purposes of sale and exchange. These sets are to be found in all the large herbaria of the world. I believe it is now impossible to furnish complete sets. He brought out of Mexico alone over 12,000 numbers, very many of which were new to science.

His own herbarium, now the property of the University of Vermont, "The Pringle Herbarium," contains about 160,000 mounted plants and occupies two rooms, each 40 by 45 feet, in addition to office and storeroom. He was very busy the past winter making exchanges and buying plants to increase its size. The additions he made this year will approximate 30,000.

During the past year Dr. Pringle, although far from being as vigorous in bodily health as he was mentally, hoped to make another trip. Owing to the revolution in Mexico, he was considering South America as a field for this work, but his indomitable will and energy had carried him beyond his strength and an attack of pneumonia together with other complications cut short the life that had been so full of energy and masterful achievements.[1]

GEORGE P. BURNS

UNIVERSITY OF VERMONT

THE INAUGURATION OF THOMAS EDWARD HODGES AS PRESIDENT OF WEST VIRGINIA UNIVERSITY

THE formal inauguration of Dr. Thomas E. Hodges, late member of the State Board of Control, and formerly professor in the university, as president of the State University of West Virginia took place on Friday, November 3, 1911.

The various exercises incident to the inauguration lasted several days, and were initiated by President Taft, on Wednesday morning, when he addressed a large gathering of

[1] An extended biography of Dr. Pringle by Professor Ezra Brainard will soon appear in *Rhodora*.

university and town people from the steps of one of the university buildings.

This meeting, which was presided over by Governor William E. Glasscock, being of an academic rather than of a political character, the President refrained from the discussion of politics, and, after a few remarks of a congratulatory character, spoke at some length upon the subject of the "Judicial Settlement of International Disputes."

The next exercise of a formal character was the "Educational Meeting" of Thursday night, at which the State Superintendent of Education, Morris P. Shawkey, presided. The program consisted of two formal addresses and several musical selections.

The first address was by Dr. Fletcher B. Dressler, of the United States Bureau of Education, upon the "Duties and Opportunities of the Modern Scholar."

The second address was by President Edwin A. Alderman, of the University of Virginia, upon "The Universities and the National Spirit."

The exercises of Friday morning, presided over by Retiring-President Daniel B. Purinton, began with an academic procession of the visiting delegates and the local faculties to the assembly hall.

After a musical number and the invocation the delegates, more than sixty in number, and representing institutions of learning and scientific bodies from Maine to California, were formally introduced by Dr. Robert A. Armstrong, chaplain of the university. The chief part of the program consisted of short greetings from eight or ten of the delegates.

The actual inaugural exercises, followed by a general reception at the Armory, took place on Friday afternoon, Governor Glasscock again presiding. After the entrance of the academic procession, a musical selection and the invocation, the charge to President Hodges was delivered by Hon. Morris P. Shawkey, president of the State Board of Regents, which was followed by the acceptance by President Hodges.

The first address of the day was by President Harry Pratt Judson, of the University of Chicago, on "The University and the State." This was followed by an address by President William Oxley Thompson, of the Ohio State University, on "The University and the People." The dominant note of these two addresses seemed to be "practical service" by the state university to the taxpayers who support the university.

Following these two addresses was President Hodges's inaugural address. This was, to some extent, a brief review of the history of the institution and a statement of some of the fundamental policies which he expects to follow in the future. While he did not in the least belittle the importance of the "practical service" aspect of university work, he emphasized more than did some of the other speakers the importance of and his desire to encourage the pure sciences and the purely cultural subjects. He expressed the belief that it would be better policy for the university to endeavor to build up existing departments rather than to create new ones, though he expressed the hope that it would not be long before it would be possible to lay more emphasis upon graduate work.

On Friday evening was held a Pan Hellenic Reunion, preceded by a torchlight procession of students and alumni. This was, of course, of an entirely informal character, and was in charge mainly of the younger alumni of the university.

Saturday was called "West Virginia Day," and the exercises consisted mainly of addresses by alumni of the university who have become prominent in some phase or other of the state's activities.

The weather was almost ideal, and the entire program was carried out without a single hitch.

With a president of force and energy, who has the confidence alike of his faculties and fellow statesmen, it would seem that a new and greater era is about to begin for West Virginia University.

A. M. R.

THE SOUTH KENSINGTON SOLAR PHYSICS OBSERVATORY

THE report of the Departmental Committee on the Solar Physics Observatory, now at South Kensington, has been issued as a Parliamentary paper and an abstract is given in the London *Times*. The committee was composed of Sir T. L. Heath, assistant secretary of the treasury (chairman); Mr. F. W. Dyson, F.R.S., astronomer-royal; Dr. R. T. Glazebrook, F.R.S., director of the National Physical Laboratory, and Professor Arthur Schuster, F.R.S., chairman of the executive committee of the International Union for Solar Research, with Mr. F. G. Ogilvie, C.B., as secretary.

The terms of reference were:

To consider the alternative schemes for locating the Solar Physics Observatory at Fosterdown and at Cambridge, respectively, and to report which of the two schemes is likely to secure the best results for an annual expenditure of approximately the same amount as is now incurred for the work done under the direction of the Solar Physics Committee.

The committee discuss the question in considerable detail, and three of them—Sir T. L. Heath, Mr. Dyson and Professor Schuster—agree on the following "conclusion and recommendations":

We are of opinion that, on a balance of considerations, and especially having regard to the advantage to the progress of solar physics which may be expected to accrue from the establishment and support by the university of a real school combining the studies of solar physics and astrophysics, the Cambridge scheme is calculated to give the better results for an expenditure of approximately the amount now available for the Solar Physics Observatory.

We recommend, therefore, that the solar physics work be transferred to Cambridge, with an initial grant for buildings and a fixed annual inclusive grant-in-aid to the university, provided that the university will agree to the following conditions:

1. That the professor of astrophysics be the director of the Solar Observatory.

2. That there be a committee or syndicate nominated by the university with functions similar to those of the board of visitors of the Royal Observatory at Greenwich.

3. That the astronomer-royal and the director of the Meteorological Office be *ex officio* members of the committee or syndicate.

4. That the university undertake to carry out at the new observatory the necessary amount of routine work on the general lines indicated in paragraph 14 (*b*) and (*c*).

5. That an annual report, to include a statement of the work done, and an abstract of the accounts of the Solar Observatory showing the application of the grant-in-aid, be presented by the director to the committee or syndicate, to be by them transmitted to the Treasury.

With a view to securing the permanence of any arrangement that may now be made, the committee desire to point out the importance of attaching the directorship of the Solar Observatory, if established at Cambridge, to a professorship which is not merely of a temporary character. The university may not be in a position at present to give any definite assurance that the professorship will be renewed at the expiration of the present tenure; but we consider it highly desirable that the government should ascertain, before coming to a final decision, whether the university is willing at an early opportunity to consider favorably the establishment of a professorship of astrophysics on a permanent foundation.

Dr. Glazebrook, however, dissents with great regret from his colleagues' conclusion and recommendations. He says:

I believe that the evidence placed before the committee and the facts detailed in the report lead to the conclusion that, on a balance of all the considerations, a scheme for locating the observatory at Fosterdown . . . could be arranged at an annual cost of £3,000, with a capital outlay of £5,000, and would secure the best results.

It appears from an appendix that Sir Norman Lockyer, F.R.S., director of the Solar Physics Observatory, is not in favor of the transference to Cambridge, and recommends the Fosterdown site.

SCIENTIFIC NOTES AND NEWS

THE Jean Reynaud prize of ten thousand francs, awarded by the Paris Academy of Sciences every five years, has been bestowed this year on Professor Emile Picard, for his contributions to mathematics.

The De Morgan medal of the London Mathematical Society has been awarded to Professor Horace Lamb, F.R.S., for his researches in mathematical physics.

The Royal Scottish Geographical Society has awarded its gold medal to Mr. J. Y. Buchanan, F.R.S., for his services to geography, especially in oceanographical research.

Mr. Frederick Gowland Hopkins, M.A., F.R.S., formerly fellow and tutor, and Mr. Rowland Harry Biffen, M.A., professor of agricultural botany, have been elected honorary fellows at Emmanuel College, Cambridge.

Professor Peter Schwamb, who graduated from the Massachusetts Institute of Technology in 1878 and was appointed instructor there in 1883, being since 1901 professor of machine design, has retired from active work under the provisions of the Carnegie Foundation.

Mr. R. J. Godlee has been elected president of the Royal College of Surgeons of England, in succession to Sir Henry Butlin.

In reply to an inquiry as to the award of the Nobel prizes, Professor Svante Arrhenius has sent to *Nature* the following information: (1) *Prize for medicine:* awarded on October 21, the birthday of Dr. Alfr. Nobel, by the Carolinian Institute (faculty of medicine) in Stockholm to Dr. Allvar Gullstrand (born 1862), professor of ophthalmology in the University of Upsala, Sweden, for his investigations in physiological optics. (2) *Prize for physics:* awarded on November 7 by the Royal Academy of Sciences, Stockholm, to Dr. Willy Wien (born 1864), professor of physics at the University of Würzburg, Bavaria, for his discoveries regarding the laws of radiation. (3) *Prize for chemistry:* awarded on November 7 by the Royal Academy of Sciences, Stockholm, to Mme. Marie Curie (born 1867), professor of physics in the University of Paris (Sorbonne), for her discoveries of the chemical elements radium and polonium, and her investigations regarding their chemical properties. Mme. Curie received, together with her husband, the half of the Nobel prize for physics in 1903 for their investigations regarding the Becquerel rays. (4) *Prize for literature:* awarded on November 9 by the Royal Swedish Academy of Literature, Stockholm, to Maurice Maeterlinck (born 1862). The prize for work in the cause of peace will probably not be awarded before December 10, the day of Dr. A. Nobel's death, by the Storthing (Parliament) in Christiania, Norway.

Professor W. E. Castle, of the Bussey Institution, Harvard University, has gone on a zoological expedition to Peru, to be absent about three months. His headquarters will be at the Harvard Astronomical Observatory, Arequipa.

Dr. D. T. MacDougal and Mr. G. Sykes, of the Desert Botanical Laboratory, will visit the region between Khartoum and the Red Sea early in 1912, and later undertake some extended work in the Libyan oases. Attention will be devoted chiefly to the extension of studies on the features of desert basins upon which some work has been done in the Salton, and in the Otero basin in New Mexico. Dr. MacDougal sailed to join Mr. Sykes in England on November 23. He will lecture on "North American Deserts" before the Royal Geographical Society on December 18.

Lieut. Col. Edgar A. Mearns, U.S.A., retired, associate zoologist of the United States National Museum, who accompanied the Smithsonian expedition to Africa, under the direction of Colonel Theodore Roosevelt, will be attached as naturalist to the Childs Frick Abyssinian expedition, which shortly sails from London to make natural history collections in the Abyssinian region. The party will consist of Mr. Childs Frick, son of Mr. Henry C. Frick, Mr. Blick, a friend of the former, Dr. Mearns and a physician. It is the plan of the organizer to make as complete a collection of the animals of the Abyssinian region as possible. The birds will be prepared by Dr. Mearns for the National Museum, where they will be studied and reported on; the other animals, including big game, will be prepared by Messrs. Frick and Blick, both of whom have taken preliminary lessons in taxidermy and field prepa-

ration in order to qualify themselves as field taxidermists. Dr. Mearns recently sailed from New York on the *Mauritania* for London. From there the party will go to Aden, Arabia, on the Gulf of Aden, where they will outfit. They will then cross the Gulf of Aden and plunge directly into the wilderness.

THE Entomological Society of America offers each year at its annual meeting held during convocation week an evening lecture dealing with some phase of insect morphology or ecology of particular interest to zoologists and entomologists. This lecture will be given this year by Professor John Henry Comstock, of Cornell University, on Wednesday evening, December 27. His subject will be, "On Some Biological Features of Spiders." The lecture will be illustrated with lantern slides.

ON November 16 the New York Academy of Medicine held its anniversary meeting. The address of the evening was made by Dr. James Ewing, New York City, who took for his subject "The Medical Profession and the Public."

DR. G. STANLEY HALL, president of Clark University, delivered the address at the inauguration of Dr. George E. Myers, principal of the State Manual Training Normal School at Pittsburg, Kansas. The subject of the address was "Educational Efficiency."

PROFESSOR JOSEPH JASTROW, of the University of Wisconsin, will give a public lecture "On the Trail of the Subconscious," at the university on December 4, under the auspices of the university association for research and Phi Beta Kappa.

ON the evening of November 18 Professor W. Johannsen, of the University of Copenhagen, lectured before the Indiana Chapter of Sigma Xi and invited guests on the subject "Selection in the Light of Pure Line Work." The lecture was followed by a formal reception. The officers of the Indiana Chapter of Sigma Xi for the current year are: *President,* Dr. J. W. Beede; *vice-president,* Dr. C. E. May; *recording secretary,* Dr. Ferd. Payne; *corresponding secretary,* Miss Mary Harmon; *treasurer,* Dr. F. C. Mathers.

PROFESSOR S. A. MITCHELL, of Columbia University, has been lecturing in Philadelphia on successive Saturdays, beginning November 4 on the subject of "Astronomy." The titles of the lectures are (1) "Common Things about the Earth," (2) "The Sun—Typical Star," (3) "Evolution Revealed by the Spectroscope," (4) "The Moon, a Worn-out World," (5) "Fragments of other Worlds," (6) "Is Mars Inhabited?"

THE first lecture in the season's course of the Montreal Branch of the Archeological Institute of America was delivered in the chemistry building at McGill University, Montreal, by Harlan I. Smith, dominion archeologist, on the subject "The Archeology of Western Canada."

THE eighty-sixth Christmas course of juvenile lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Dr. P. Chalmers Mitchell, F.R.S., secretary of the Zoological Society, on "The Childhood of Animals."

THE Berthelot memorial lecture of the Chemical Society was delivered by Professor H. B. Dixon, F.R.S., on November 23.

THE annual Huxley memorial lecture of the Royal Anthropological Institute was delivered on November 23 by Professor F. von Luschan, whose address was on "The Early Inhabitants of Western Asia."

PROFESSOR KARL PEARSON is preparing a memoir on the life and work of the late Sir Francis Galton.

SURGEON GENERAL WALTER WYMAN, of the U. S. Public Health and Marine Hospital Service, died on November 21, aged sixty-three years.

MR. DANIEL F. DRAWBAUGH, the American inventor, has died at the age of eighty-four years.

SIR SAMUEL WILKES, an eminent London physician, author of works on pathological anatomy, died on November 8, at the age of eighty-seven years.

DR. R. D. ROBERTS, registrar of the Board of Extension of University Teaching, University of London, at one time university lec-

turer on geology at Cambridge, died on November 14, at the age of sixty years.

Among the New York State Civil service examinations on December 9 is one for bacteriologist of the Port of New York at a salary of $1,200.

The annual meeting of the Society of American Bacteriologists will be held in Washington, D. C., December 27, 28 and 29, 1911. The headquarters will be at the New Ebbitt and the sessions at the Cosmos Club. A six o'clock dinner will be given at the Cosmos Club on December 28. The president's address, by Professor F. P. Gorham, considering "Biochemical Problems in Bacteriology," will follow the dinner. The report of the Committee on Microbiological Teaching and Education will be presented after the president's address by the chairman, S. C. Prescott. The whole field will then be open for discussion. Some of the session programs are already in the hands of the secretary. Any one wishing to present a paper should write one of the individuals named below who has in charge the general topic under which the subject may fall: *Systematic Bacteriology,* Professor C. E. A. Winslow, College of the City of New York, New York; *Physiologic Bacteriology* (including antibodies), Dr. John F. Anderson, director of the Hygienic Laboratory, 25th and E Streets N. W., Washington, D. C.; *Soil Bacteriology,* Professor Jacob G. Lipman, director of the Experiment Stations, New Brunswick, N. J.; *Dairy Bacteriology,* Professor E. G. Hastings, College of Agriculture, University of Wisconsin, Madison, Wis.; *Plant Pathologic Bacteriology,* Professor F. L. Stevens, North Carolina Agricultural College, West Raleigh, N. C.; *Human and Animal Pathologic Bacteriology,* Dr. M. Dorset, chief of the Biochemic Division, Bureau of Animal Industry, Washington, D. C.

As already announced, the eighteenth International Congress of Americanists will be held in London May 27 to June 1, 1912. Members who desire to inspect Dr. W. Allen Sturge's magnificent collection of stone implements in his museum at Icklingham Hall, Suffolk, should communicate with Miss A. Breton, Royal Anthropological Institute, 50 Great Russell Street, London, W. C. A visit can be made in the day from London; Dr. Sturge will arrange for conveyance from the station.

The installation of the work of the Venice Marine Biological Station of the University of Southern California occurred on November 10. Addresses were delivered by President Bovard, Mr. Abbot Kinney, Professor Ulrey, Dean Healy and Professor Edwards. Through the generous cooperation of the Abbot Kinney Company the station has a biological reservation consisting of the Venice pier and breakwater and of one and one half miles of canals. The protected breakwater will be used by Professor Edwards for his work under the California Fish and Game Commission on the colonization of the various species of abalones and other forms and for experiments in pearl production. The canals, with water having 75 per cent. of the salinity of the contributing sea, will be devoted to acclimatization cultures. A motor sloop, the *Anton Dohrn,* has been completed for work in the neighboring region, including the islands off the coast of Southern California.

We learn from *Nature* that the council of the Royal Institute of Public Health has accepted an invitation from the chief burgomaster of Berlin to hold the congress next year in that city on July 25–28. The congress will include the following sections and presidents: state medicine, Sir T. Clifford Allbutt, K.C.B., F.R.S.; bacteriology and comparative pathology, Professor G. Sims Woodhead; child study and school hygiene, Sir James Crichton-Browne, F.R.S.; military, colonial and naval, Major Sir Ronald Ross, K.C.B., F.R.S.; and municipal engineering, architecture and town planning, Mr. P. C. Cowan. Facilities will be afforded for visiting the various public health and educational institutions in Berlin in connection with the Imperial Board of Health, the municipality and the university.

It is reported in *Nature* that in connection with the two hundredth anniversary of the

foundation of the Spalding Gentlemen's Society, in 1709, the society has recently built a home for its library and museum, which also includes a magnificent lecture theater, committee rooms, etc. The new building was opened on October 25 by Sir Henry H. Howorth, K.C.I.E., F.R.S., who referred to the extraordinary fact that a society should have carried on its work for two centuries and should then be in a position to purchase a building for its treasures. In the evening there was a public lecture on "The Romans in Lincolnshire," by Mr. T. Sheppard, in which he described many thousand relics of the Roman period, now in the museum at Hull, from a little-known site on the north Lincolnshire coast. Sir Harry Howorth occupied the chair. During the day Mr. Sheppard also gave an address on the use and value of local museums.

IN the general estimates for appropriations for the fiscal year 1912, which begins July 1, 1912, Secretary of the Interior Walter L. Fischer has recommended the following items for the Bureau of Mines: For the investigation as to the causes of mine explosions, methods of mining, especially in relation to the safety of miners, the appliances best adapted to prevent accidents, the possible improvement of conditions under which mining operations are carried on, the use of explosives and electricity, the prevention of accidents, and other inquiries and technologic investigations pertinent to the mining industry, $360,000. For the investigation, analyzing and testing of the coals, lignites and other mineral fuel substances belonging to or for the use of the United States, $135,000. For investigations into the treatment of ores and other mineral substances, with special reference to the prevention of waste in the mining and utilization of important mineral resources, $100,000. For the investigations of the coals of Alaska, with reference to their mining, transportation and utilization, $50,000.

THE total coal production of the world in 1910 was approximately 1,300,000,000 short tons, of which the United States contributed about 39 per cent. This country has far outstripped all others, and in 1910, according to the United States Geological Survey, it exceeded Great Britain, which ranks second, by over 200,000,000 tons. Great Britain's production in 1910 was less than 60 per cent. of that of the United States, and Germany's was less than half. The increase in both of these countries in 1910 over 1909 was comparatively small, whereas the increase in the United States was nearly equal to the entire production of France and was more than the total production of any foreign country except Great Britain, Germany, Austria-Hungary and France. The United States has held first place among the coal-producing countries of the world since 1899, when it surpassed Great Britain. In the 11 years since 1899 the annual output of the United States has nearly doubled, from 253,741,192 short tons to 501,596,378 tons, whereas that of Great Britain has increased only 20 per cent., from 246,506,155 short tons to 296,007,699 tons. The following table shows the coal production of the principal countries of the world in 1910, except those for which only the 1909 figures are available:

United States (1910)	501,596,378
Great Britain (1910)	296,007,699
Germany (1910)	245,043,120
Austria-Hungary (1909)	54,573,788
France (1910)	42,516,232
Belgium (1910)	26,374,986
Russia and Finland (1910)	24,967,095
Japan (1909)	16,505,418
Canada (1910)	12,796,512
China (1909)	13,227,600
India (1909)	13,294,528
New South Wales (1909)	7,862,264
Spain (1909)	4,546,713
Transvaal (1910)	4,446,477
Natal (1910)	2,572,012
New Zealand (1909)	2,140,597
Mexico (1909)	1,432,990
Holland (1909)	1,235,515
Queensland and Victoria	1,119,708
Italy (1909)	611,857
Sweden (1909)	272,056
Cape Colony (1909)	103,519
Tasmania (1909)	93,845
Other countries	5,236,903
Total	1,278,577,812

Secretary Wilson has decided that the interests of cities and towns which obtain their water from streams having their watersheds within national forests call for special measures of protection, and he has therefore developed a plan of cooperation for the Department of Agriculture with those communities which are alive to the importance of keeping their water supply pure. There are many western towns and cities, some of them of large size, which derive their water from drainage basins lying inside the national forests. One of the recognized objects of forestry is to insure the permanence and protect the purity of municipal water supplies. As the forests are maintained for the benefit of the public Secretary Wilson considers it the duty of his department to do all that it can both to prevent the pollution of such supplies and to create or maintain conditions most favorable to a constant flow of clear water. Stock raising and occupancy of the land for the various kinds of use which are ordinarily encouraged on the national forests may be highly undesirable if allowed on drainage basins which are the sources of drinking water. There is also to be considered the injury which may be done if the water is silt-laden. By protecting and improving the forest cover and by enforcing special regulations to minimize erosion and to provide for the maintenance of sanitary conditions, the government will try to safeguard the interests of the public. A form of agreement has been drawn up, providing that, when cooperation is entered into between the Secretary of Agriculture and any city desiring conservation and protection of its water supply, the secretary will not permit the use of the land involved without approval by the town or city except for the protection and care of the forests, marking, cutting and disposing of timber which the forest officers find may be removed without injury to the water supply of the city, or for the building of roads, trails, telephone lines, etc., not inconsistent with the objects of the agreement, or for rights of way acquired under acts of Congress. The secretary also agrees to require all persons employed on or occupying any of the land both to comply with the regulations governing national forests and to observe all sanitary regulations which the city may propose and the secretary approve. The agreement provides for the extension and improvement of the forests on the part of the government by seeding and planting and the best methods of silviculture and forest management, so far as the funds available will permit. The city on its side is expected to assist in the work by paying the salaries of the additional guards necessary to carry out the agreement, and in case extensive forest operations are immediately desired by the city, it would bear the major part of the cost entailed by this work.

Anti-typhoid vaccine will be supplied to Wisconsin physicians free of charge by the state hygienic laboratory at the University of Wisconsin, beginning on December 1, according to the announcement just made by Dr. M. P. Ravenel, head of the department of bacteriology at the state university and director of the laboratory. When the vaccine is ready for distribution full directions for its use will be issued, the only condition being that physicians agree to make a report of the results to the laboratory. To prevent the spread of typhoid it is recommended that where one case of typhoid fever occurs in a family, the other members be vaccinated promptly. In the distribution of the vaccine the authorities of the hygenic laboratory desire to secure the cooperation of physicians generally, and with that end in view are requesting that suggestions be made by practising physicians before the distribution begins, December 1. The decision of the director of the hygienic laboratory to furnish anti-typhoid vaccine grows out of the success which has attended its use in the United States army, where the results have been so striking that the secretary of war, acting on the advice of the surgeon general, has made anti-typhoid vaccination compulsory for all officers and enlisted men under

45 years of age. Before it was made compulsory, 17,000 officers and enlisted men had been vaccinated voluntarily. During the recent mobilization of troops in Texas, when the men were in camp for more than two months, under war conditions, only one case of typhoid resulted, that of a teamster who had not been vaccinated. This was in striking contrast to the Spanish-American war when within a period of three and one half months there were 20,738 cases with 1,580 deaths.

UNIVERSITY AND EDUCATIONAL NEWS

LARGELY through the efforts of Mrs. E. H. Harriman, a fund of $40,000 a year for five years has been provided to maintain an experimental school for the study and administration of public business. The school will be started in New York, but the scope is intended to be national. Mrs. Harriman personally consulted a number of business men, journalists, educators and public officials as to the need of providing such a training school, and their favorable replies resulted in her offer of a contribution to make possible a five years' test of such a school. Her own contribution was $40,000 for the first year and $10,000 for the succeeding years. Messrs. John D. Rockefeller, Andrew Carnegie, J. P. Morgan and others gave enough to provide for a total annual income of $40,000. The work will be carried on by the directors of the Bureau of Municipal Research.

THE statute allowing honor students in mathematics and natural science to dispense with Greek in responsions passed the Oxford congregation on November 7 by a vote of 33 to 11. It will now be submitted to convocation, the ultimate legislative authority of the university.

DR. EDMUND B. HUEY, who has for some time been making examinations of defective children and of aphasic patients at the Johns Hopkins Hospital, has been appointed lecturer on mental development in the Johns Hopkins University and assistant in psychiatry in the Phipps Clinic of the Johns Hopkins Hospital. From January to June, 1912, Dr. Huey will give, at the university, a series of weekly public lectures and clinics on the subject of backward and feeble-minded children, and on related phases of clinical psychology.

DR. ALFRED N. GOLDSMITH has been appointed instructor in physics in the College of the City of New York.

DR. ALEXANDER F. CHAMBERLAIN, hitherto assistant professor, has been promoted to a full professorship in anthropology at Clark University.

PROFESSOR R. I. SMITH, of the North Carolina College of Agriculture, has accepted a position with the Porto Rico College of Agriculture, taking up extension work in agricultural education. His address after January 1, 1912, will be Mayaguez, Porto Rico.

DISCUSSION AND CORRESPONDENCE

THE USE OF SODIUM BENZOATE AS A PRESERVATIVE OF FOOD

TO THE EDITOR OF SCIENCE: It seems proper that the following quotation of the Prussian Scientific Deputation of Medical Affairs should be published in addition to that copied by SCIENCE from an article in the *Journal of the American Medical Association*, that the American public shall not be misled:

> In order to decide the question concerning the use of benzoic acid and its salts as a preservative of food, one must consider the result of the prolonged administration of these substances in small doses. Such experiments were carried out on twelve young men in the chemical laboratory of the Agricultural Department in Washington under the direction of Wiley. The persons experimented on received, in increasing quantities, between 0.5 to 2.5 grams of benzoic acid or benzoate in capsules during four periods of five days each. The majority of the persons experimented on experienced digestive and metabolic disturbances, gastric pain, vomiting and reduction in body weight, which decided Wiley to declare that the use of benzoate salts should not be allowed in the preservation of food. Since, however, doubts arose regarding the technic of these experiments and since the injury to the health of the individuals could not with certainty be attributed to the use of benzoate of soda, an American commission ap-

pointed by President Roosevelt has tested Wiley's results. Three independent series of experiments were carried out extending over a period of four months, by R. H. Chittenden at the Sheffield Scientific School, Yale University, on six young men, by J. H. Long at the Medical School of the Northwestern University in Chicago on six individuals and by Christian A. Herter in his private laboratory of Columbia University on four individuals. The experiments were so arranged that during two months 0.3 gram of sodium benzoate was given daily in three doses in the food or drink. During a third month the dose given was gradually increased at first to 0.6 and then to 1 gram, while in some experiments 4 and 6 grams were given daily. The experiments in which the dose of 0.6 to 1 gram were given lasted between 8 to 14 days, and with the largest doses 2 to 8 days. The food ingested and the excreta were analyzed and the individuals were carefully observed. The commission draws the following conclusions:

1. Sodium benzoate in small doses (under 0.5 gram) when given with food is harmless, is not poisonous and not injurious to health.

2. Larger doses of sodium benzoate (4 grams daily) are not injurious to health, and are not poisonous in the general sense of the term. In certain ways they exercise a slight action over certain physiological processes, the exact significance of which is not determined.

3. Addition of sodium benzoate in large or small doses to food exercises no injurious influence on the quality or the nutritive value of the food.

The changes in certain physiological phenomena mentioned under 2 are concerned with the observations of Herter. In his experiments sodium benzoate in the larger doses caused a slight increase in the indigo-forming substances in the urine, a change in the bacterial-flora of the feces and a decided increase in the production of hydrochloric acid in the gastric juice.

Putting everything together, it may be stated that benzoic acid and sodium benzoate exercise a poisonous action on the organism only when given in comparatively large amounts. The constant occurrence of hippuric acid (the substance produced by the union of benzoic acid and glycocoll) in human urine leads to the conclusion that small quantities of benzoate salts arising from vegetable food or products of its oxidation, are always circulating in the blood. One may conclude from this as well as from the experiments of the American Commission, that benzoic acid in amounts up to 0.5 gram distributed in small doses during the day are harmless to the human organism. Whether larger doses (amounts of several grams) can be constantly taken by all individuals with the same impunity can not now be stated. The experimental work of the American scientists in this particular was not continued long enough and their conclusion was associated with certain reservations, so that it can not be considered as affording the proof of absolute harmlessness.

For this report consult *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Bd. 22, p. 261, July 15, 1911.

With regard to the common origin of the garbled extracts of the Prussian Deputation's Report furnished to the American press, let the following sorrowfully be recorded:

The report made by the health officials of Germany on the use of benzoate of soda in foods and which sustains the position originally taken by Dr. Wiley, of the United States Bureau of Chemistry, and is antagonistic to the position taken by the Remsen Board, has been transmitted to the Agricultural Department by the officials of the State Department.—*Oil, Paint and Drug Reporter*, October 16, 1911.

and,

Until a question is settled right it will never stay settled, and the benzoate of soda controversy seems to be one of these questions. The latest to have a word on the question is the Scientific Deputation for Medical Affairs in Germany. . . . This deputation has taken the tests made by Dr. Wiley at their face value, thus confirming the stand taken by those in this country who would prohibit the use of benzoate of soda in all food products.—Government Agricultural Experiment Station, Agricultural College, N. D. *Special Bulletin*, Food Department. Vol. I., No. 36, September, 1911.

and,

The American public believes that a question is not settled until it is settled right. . . . Of the decision of the United States referee board, these German scientist say: "The series of experiments in this connection made by the American scientists are of too short duration and the results coupled with certain limitations, so that they can not be regarded as demonstrating the unconditional non-injurious nature."—*Journal of the American Medical Association*, Vol. XLVII., No. 19, November 4, 1911.

GRAHAM LUSK

A FEW MATHEMATICAL ERRORS IN THE RECENT EDITION OF THE ENCYCLOPÆDIA BRITANNICA

As a large number of students do not have easy access to extensive special literature, they are led to regard general works, such as the Encyclopædia Britannica, as the supreme authority on many questions. It may, therefore, be of interest to call attention to a few conspicuous errors in the new edition of this excellent work. On page 857 of volume 19 (1911), we read as follows: "What is quite certain is that our present decimal system in its complete form, with the zero which enables us to do without the ruled columns of the abacus, is of Indian origin." How far this is from the truth may be inferred from the following paragraph.

During the meetings of the second international congress of mathematicians held in Paris in 1900 the eminent German mathematical historian, Moritz Cantor, expressed the opinion that the use of zero was probably discovered by the Babylonians about 1700 B.C.[1] In the third edition of volume I. of his classic "Vorlesungen ueber Geschichte der Mathematik," 1907, page 616, Cantor remarks that according to his opinion the discovery of zero is due to the Babylonians, while the deepening (Vertiefung) of the concept is due to the Hindus.

A more decided error is expressed on page 626 of volume 12, in the following sentence: "The technical mathematical sense (of the term group) is not older than 1870." It is surprising that such a statement could emanate from the country where Cayley worked and developed the foundations of abstract group theory as early as 1854. It is well known that Galois (1811–32) was the first to use the term group as a technical mathematical term, with its present significance, and that Cayley and Kirkman employed this term with its technical mathematical sense in a number of articles, published before 1870, in the *Philosophical Magazine* and in the *Memoirs* and *Proceedings* of the Literary and Philosophical Society of Manchester.

[1] *Bulletin of the American Mathematical Society*, Vol. 7 (1900), p. 70.

Closely related to the error noted in the preceding paragraph is the following, which appears under the word *Galois:* "To him (Galois) is also due the notion of group of substitutions." While the technical mathematical term group is due to Galois, as we observed in the preceding paragraph, the *notion* of group is very much older. According to Frobenius and Stickelberger, the theory of finite abelian groups was founded on the one hand by Euler and Gauss, and on the other by Lagrange and Abel; and, according to Poincaré, the principal foundation of Euclid's demonstrations is really the existence of the group and its properties.[2] No one acquainted with the history of group theory would say that the *notion* of group of substitutions was due to Galois.

In the first volume of the Encyclopædia Britannica under the term *abscissa* we find the following incorrect statement: "The word (abscissa) appears for the first time in a Latin work written by Stefano degli Angeli (1623–1697), a professor of mathematics in Rome." As early as 1903 C. R. Wallner pointed out in the *Bibliotheca Mathematica*, page 37, that the statement in Cantor's "Vorlesungen ueber Geschichte der Mathematik," which might furnish the basis of the error under consideration, is incorrect. In a recent part of the Encyclopédie des Sciences Mathématiques, tome 3, volume 3 (1911), page 1, G. Eneström points out that the origin of the word abscissa goes back to the Latin translations of the "Conic Sections" by Apollonius, written in the third century before Christ. Eneström gives, at this place, numerous references in regard to the early use of the term abscissa.

Another incorrect statement appears in the article on number theory, volume 19, page 851, and reads as follows: "By totient of n, which is denoted after Euler by $\phi(n)$, we mean the number of integers prime to n and not exceeding n." While Euler studied some of the properties of the totient of n he did not use the symbol $\phi(n)$. This symbol, as far as we know at present, was first used by Gauss in article 38 of his "Disquisitiones Arithmeticæ,"

[2] *The Monist*, Vol. 9 (1898), p. 34.

1801. The function of n represented by $\phi(n)$ is, however, generally called Euler's function, since Euler had studied some of its fundamental properties before the appearance of Gauss's "Disquisitiones."

It is a well-known fact that it is easy to find errors in nearly every book and the few errors noted above would be of very little interest if they did not occur in such an excellent work. As they were met incidentally, it is not implied that they include the most important mathematical errors in the work under consideration. They may perhaps serve to emphasize the great importance of a thorough study of the question on hand before expressing a definite conclusion, and also the large amount of labor involved in such a study. There is a vast amount of error afloat even in the best literature of the present time, and this calls for a larger army of workers who investigate questions *ab initio* and who are fearless in resisting the tendency towards the further spreading of these weeds on the intellectual earth.

G. A. Miller

University of Illinois

MORE WASHINGTON SCIENCE

To the Editor of Science: I have been reading with much interest the recent communications on Washington science. No one will deny credit to the scientists who are giving the government department their best energies. Still, these same men are occasionally lacking in—I am almost tempted to say a system of professional ethics. I have been quite near the inside of Washington methods and herewith present the case.

In the event of choosing a scientific assistant for a vacancy, I have known in several cases that the matter of minimum salary the applicant would accept was of paramount importance while the ability and training of the applicant seemed to be an insignificant matter. I know cases where men with practically no college or scientific training of any sort were preferred to college graduates with experience, because the former could be obtained for five dollars a week less. I know a case in one division where $100 per year represents the difference between the beginning salary of an untrained man and that of a post-graduate of a large eastern university. I do not refer to men appointed under the civil service competitive examination, but rather to those who come under the general heading of agents and experts, who are appointed merely at the recommendation of a division chief. Many of us know of cases wherein good men were discouraged, by this state of affairs, to the extent of entering other lines of endeavor. It is now in order for some one to sign an earnest communication containing the phrases "love of science," "mercenary," etc. To one interested in this subject I would suggest looking up the records of resignations of very good men from the government bureaus as a result of the order of Secretary Wilson (1909) that no promotions were to be made for the next fiscal year. Is there not a system of ethics in these matters?

For obvious reasons, I emulate my predecessors and sign myself

A Former Washingtonian

COLUMBIA AND BERLIN

A statement has recently appeared in a number of newspapers to the effect that Columbia University having passed the University of Berlin in attendance is now the largest university in the world. As a matter of fact it will probably be several years before the attendance at Columbia exceeds that of Berlin. The error in calculation has arisen primarily from the fact that the Columbia figures include not only the fall attendance but also the enrollment of the summer session of 1911, proper allowance, of course, being made under duplication for the summer session students who returned for work this fall. The figures of the University of Berlin, with which a comparison has been made, include, however, only the attendance during the winter semester, the summer semester enrollment not being considered. Inasmuch as registration at the University of Berlin for the winter semester of 1911–12 is not yet completed, it is simpler to make a comparison between

the attendance at Columbia University during the academic year of 1910–11 and the attendance at Berlin during the winter semester of the same year, leaving the summer session students out of consideration in both cases.

There were matriculated at the University of Berlin last winter, 9,686 students, distributed as follows: Protestant theology, 406; law, agriculture and forestry, 2,429; medicine, pharmacy and dentistry, 1,864; philosophy, pure science, etc., 4,987. In addition 778 men and 256 women were enrolled as auditors, so that the total attendance amounted to 10,720, this being exclusive of 4,664 auditors registered at other Berlin schools of university rank. Leaving the auditors out of consideration, the University of Berlin had an attendance last winter of 9,686 students, as against Columbia's 5,893, the latter being distributed as follows: undergraduates, 1,349; theology, —; law, 376; medicine, 329; pharmacy, 275; applied science, 724; architecture and music, 182; political science, philosophy and pure science, 1,367; Teachers College, 1,571 (280 duplicates). Of the 1,349 undergraduates, 839 were enrolled in the freshman and sophomore classes, and these students in Germany would correspond to the two last years of the secondary schools—*i. e.,* they would not be of university grade in Germany. Omitting these students, the total would be reduced to 5,054. Then if we subtract the enrollment of Teachers College, the faculty of applied science and the faculty of fine arts, we would have compared with the 9,280 students enrolled at Berlin in the various faculties, exclusive of theology, only 2,857 students at Columbia. The number of students in agriculture, forestry and dentistry at Berlin—departments not represented at Columbia—is not large enough appreciably to affect the result. The law and medical schools at the University of Berlin are each about five times as large as the corresponding schools at Columbia, and the Berlin non-professional graduate students are more than three times as numerous as they are at Columbia. It must also be borne in mind that in general the requirements for admission to the professional schools, with the exception of law and medicine, are—with few exceptions—higher at Berlin and other German universities than they are at Columbia and elsewhere in the United States.

In the same year the University of Munich had an enrollment of 6,905 students, exclusive of auditors, and Leipsic had an enrollment of 4,900 students, so that the former at least may be regarded as being larger than Columbia, no matter from which standpoint the matter may be viewed, and from certain viewpoints Leipsic is larger. The latter university, in addition to its 4,900 matriculated students, had 904 auditors, and it might thus also be considered as outranking Columbia in size. If the summer semesters for Berlin, Munich and Leipsic were added, the numerical superiority of these institutions over Columbia would become even greater, for as against Columbia's 2,632 summer session students in 1910 and 2,970 students in 1911, there were registered at the University of Berlin in the summer semester of 1910, 7,383 matriculated students and 651 auditors; at Munich there were 6,890 matriculated students and 474 auditors; and at Leipsic 4,592 students and 784 auditors. These figures are all based on reliable statistics compiled annually for the "Deutscher Universitäts-Kalender."

I might also add that compared with the 724 students enrolled at Columbia in the faculty of applied science during the academic year 1910–11, there were 2,168 students registered at the Berlin School of Technology in the winter semester of 1909–10, these students of course not being included in the enrollment of the University of Berlin.

It is also well to remember that Berlin is not the largest university in the world, this distinction belonging to the University of Paris, at which there were enrolled during the winter semester of 1909–10 no fewer than 17,512 students. At the University of Cairo there were over 10,000, at Moscow over 9,000 matriculated students, at St. Petersburg almost 9,000; at Vienna there were 6,833 matriculated students in the summer semester of 1910, at Budapest (Hungary) there were 6,683 matriculated students in the winter semester

of 1909–10; at Naples there are almost 7,000 students, and at Tokyo over 5,500.

It will probably be some time before Columbia University—in point of student enrollment the largest American university—or any other American university attains to the distinction of attracting the largest student body in the world to its halls; and in the meantime it is well to bear in mind that, after all, greatness and not bigness is the most important factor in the development of our higher institutions of learning, and that the Columbia authorities lose no opportunity to emphasize the value of quality in contradistinction to quantity.

RUDOLF TOMBO, JR.

COLUMBIA UNIVERSITY

SCIENTIFIC BOOKS

The Doctrine of Evolution: its Basis and its Scope. By HENRY EDWARD CRAMPTON, Ph.D., Professor of Zoology, Columbia University. New York, Columbia University Press. 1911. 12mo, pp. ix + 311. $1.50 net.

The difficulties of presenting scientific conceptions and results in wholly untechnical language are abundantly evidenced; they are appreciated by every one, most keenly by those who have attempted the task. Failure to achieve such a purpose seems to follow more often from falling away from the strictly scientific method and spirit, than from an inability to make facts passably intelligible.

To Professor Crampton, however, must be granted a large, if not a complete, measure of success in his attempt thus to set forth the essentials of the evolution idea. For the lucidity of his untechnical statements of facts makes his work thoroughly intelligible, while his method and the scientific spirit which pervades the work make it convincing.

This volume consists of the Columbia University Hewitt Lectures for 1907. As such they were prepared for an audience "of mature persons of cultivated minds, . . . quite unfamiliar with the technical facts of natural history." All consideration of the work must obviously be made with the nature of its adaptedness constantly in mind: it is intended as "a simple message to the unscientific."

The introductory chapter provides a setting for the evolution doctrine and includes a brief discussion of certain fundamental principles of science in general, and in particular of biology. There are the necessary descriptions of the biological sciences, of the nature of the organism, and of life processes, throughout which the wisdom of the author is evidenced by his discreet avoidance of the word "vitalism" in any of its present meanings. The second and third chapters are given to setting forth the evidences of evolution as afforded by the structure, the development, the fossil history and the geographical distribution of organisms. Factors in the process of evolution are reviewed in the fourth chapter. This concludes what might have been termed Part I. of the work, dealing with general evolution.

In the remaining chapters the author takes up various phases of human evolution for especial emphasis and more detailed treatment. Presentation of the facts regarding the "physical" evolution of the human species is followed by an account of the evidences for the evolution of the human races. This leads to an account of man's mental evolution, which is discussed from the standpoints of comparative psychology, both descriptive and genetic, of "comparative anthropology," and of the "paleontology of mind."

It is at this corresponding point that many somewhat similar accounts of evolution terminate. Professor Crampton, however, does not fail to discuss those aspects of the evolutionary doctrine which the general reader to-day regards as of the most importance, and concerning which there is the greatest need for simple, sane, scientific treatment. For there follow two chapters entitled "Social Evolution as a Biological Process" and "Evolution and the Higher Human Life." Many will find these the most valuable parts of the book, for here are reviewed, in simple terms, the fundamental evolutionary aspects of social relations, and of ethics, religion and philosophy.

In its general plan this work is not unlike

the valuable series of Romanes. Throughout it is conservative, perhaps ultra-conservative in its treatment of such topics as the biogenetic law, the heritability of modifications, and some other general subjects. And it is thoroughly orthodox; the giraffe and the blacksmith are not found wanting.

The entire American Museum of Natural History would be required adequately to illustrate so inclusive a theme as this. And the complete absence of figures, which were abundantly provided for the lectures themselves, is a serious defect. The capacity, even of the careful reader, for misunderstanding language, is enormous. Even a few well-selected figures would give the reader a frequent sense of definite concreteness which is occasionally lacking in some of the passages dealing with the facts of evolution.

There is no index.

It is safe to say that this book will prove immensely useful, and its use will not be limited to the unscientific. Students of biology and sociology will find it a valuable aid and summary. In marked and agreeable contrast to Romanes's work, it is entirely free from controversial tone, and its excellent spirit, so well evidenced by the concluding chapters, will go far toward making the doctrine of evolution completely acceptable to those who still persist in exempting from evolutionary treatment and understanding, certain large and important fields of human action and thought.

W. E. Kellicott

Guayule, a Rubber Plant of the Chihuahuan Desert. By F. E. Lloyd. Carnegie Institution of Washington, Publication No. 139. 1911. Pp. viii + 213. Plates 46, text figures 20.

It is seldom that the results of a critical study of one plant from several different viewpoints are brought together at one time within the covers of a single book. The author of Guayule has, however, collected many facts relating to the growth and utilization of *Parthenium argentatum* Gray, which are worthy of notice. The interest in the present work from the scientific standpoint is enhanced by the fact that the subject of the investigations is a native of desert regions relatively little known botanically or ecologically. From the economic standpoint it is of interest as furnishing a record of a plant of peculiar importance commercially, whose life history and habits were hitherto practically unknown, though subjects of abundant speculation and conjecture.

The first chapter presents a brief historical account of the Guayule and its use. The writer traces the development of the industry and describes some of the methods of extraction, which in this case are based upon the fact that the rubber is not produced in latex which issues from incisions in the bark, but is obtained only upon trituration of the stem, branches and roots of the plant. Involving, as it does, the immediate destruction of the whole plant, the manufacture of Guayule rubber is attended by the prospect of an early depletion of the natural supply. Hence investigations were begun looking to the placing of the enterprise upon a permanent footing.

The environment of Guayule and its biotic relations are discussed in the second chapter. *Parthenium argentatum* is distributed widely over the Mexican plateau and on hills whose soil is chiefly of limestone origin. Its altitudinal distribution is from 2,000 to 10,000 feet, though mostly from 5,000 to 6,000. The local distribution of the plants and the extent of their numerical development were carefully studied by the author, who is unable, however, to explain the almost total absence of Guayule in the alluvial soil of the broad playas. He suggests that this fact may be due to the meager aeration of the soil of the playa, and to the possibility of a slight acidity, owing to the presence of a slight quantity of humus. The reviewer has obtained results[1] that seem to show that the mechanical conditions of a fine alluvial soil are not unfavorable to the growth of Guayule. But on the other hand it should be noted that the quantity of water-soluble salts is less in

[1] *American Review of Tropical Agriculture*, May–June, 1910.

the native soil of the Guayule than in the alluvium of the garden, where the experimental grounds were located, which resembles the soil of the playa. It would, moreover, seem unlikely that acidity exists in this soil in the presence of carbonates. At all events the greater concentration of the salt solutions in the soils of the lower plain, as a possible additional factor affecting the distribution of Guayule, is well worth consideration. This conclusion is supported by the fact that the alluvial soil proved inimical to the growth of seedlings, a fact which Professor Lloyd elsewhere recognizes, and that this was not due to mechanical conditions alone has been demonstrated in carefully conducted experiments.[1] Some of the alluvial soil used was fatal to the Guayule seedlings at first, but after leaching offered no obstacle to their development (page 68), additional evidence that the salt content is in this case an important factor.

Discussing the subject of the size and form of the Guayule plant, the author states the upper limit of weight to be about 5 kilos and of height to be about one meter. The mature plants are profusely branched, the leaves and younger twigs being clothed with a silvery pubescence. The root-system, distributed chiefly through the superficial layers of the soil, is partly concerned with the usual work of absorption and partly with the function of vegetative reproduction, accomplished by long, slender members from which arise shoots called retoños. The identification of two biotypes is a matter of special interest. As to whether there were two distinct forms of the Guayule was a subject frequently discussed at Cedros. Observers sometimes remarked two forms of the plant, yet when an effort was made to delimit the characters of the two forms definitely, their distinctive marks seemed quite elusive. It would seem that the author of the present paper has happily discovered the line of cleavage.

Under the topic of reproduction the function and importance of the retoño is discussed at length. As a means of reproducing a stand of Guayule the retoño is not found to be very effective. Regeneration of the stand is brought about much more rapidly by cutting off the shrub instead of pulling it up in the harvesting process. Reproduction by seed is slow and only takes place at all on open ground under the most favorable conditions. The author concludes that a ten to fifteen year rotation is practically possible and economically advantageous, the average rate of height growth being about 3 cm. per annum.

The chapters on the anatomy of the plant (V. and VI.) present a detailed description of the structure of the young and mature plants in root, stem and leaf. In this connection it is interesting to note the effect of irrigation on the relative development of wood and bark. The volume ratio of bark to wood in the irrigated plant is near to unity in the smaller twigs to 0.27 in the larger, up to 13 mm. in diameter. In field plants the ratio for the smaller twigs approaches 2.5, being reduced to 1.7 for stems 13 mm. in diameter and approaching unity in those larger. On the other hand, in point of age the ratio of total bark produced in the irrigated plant to that of the field plant of the same age is about 5.6.

On the origin and occurrence of rubber (chapter VII.) the author informs us that 9.5 per cent. of the dry weight of the shrub is rubber. This is distributed through the pith, medullary rays and inner bark. The quantity of the rubber secreted and the time of secretion stands in relation to the water available and the seasonal activity of growth. Very little rubber is secreted during the period of active growth, and relatively little at any time in irrigated plants, but secretion proceeds more rapidly with the advance of the dry season. The function of the rubber in the economy of the plant seems obscure.

The concluding chapters deal with the experimental operation on vegetative reproduction, with seeding, and with proposed methods of cultivation. The author takes a hopeful view of the possibilities, and believes the solution of the problem of successful propagation not to be beyond the limits of practicability. From the evidence adduced it would seem that this may be possible, but the evidence also seems to point to the conclusion that an ade-

quate conservation policy with reference to the harvesting of the native crop is immediately imperative, and that it will also doubtless avail more for the perpetuity of this resource than any attempts at plantation methods.

It is to be regretted that the author has not considered in this connection the cost of the operations, upon which must depend, of course, the practicability of propagation. Since field seeding seems impracticable, except under the most extraordinary conditions, the procedure must take the form of nursery methods, involving considerable outlay in labor and equipment. Without discussing the details, for which space can not be taken here, it may suffice to say that the cost involved in these operations, computed on the basis of conditions at Cedros, seems quite prohibitive.

In conclusion, the admirable quality of this contribution should be recognized. Though lacking completeness in parts, as the author himself admits, there are in this work, nevertheless, the abundant results of careful and painstaking research. The magnitude of the accomplishment is the more apparent to the reviewer, as one familiar with the difficulties and discouragements which beset its author during the year upon the hacienda.

J. E. KIRKWOOD

Les syénites néphéliniques de l'Archipel de Los et leurs minéraux. By A. LACROIX. Extrait des nouvelles archives du Museum, Series 5, Vol. III. Paris. 1911. 4to. Pp. 132, 10 plates and text illustrations.

In any work from the fertile pen of M. A. Lacroix we are accustomed to expect the thoroughness and accuracy that distinguish the present petrographic study on the nephelinic syenites of the Isles of Los off the coast of Guinea. This group of islands was ceded to France by the Anglo-French convocation of 1904.

M. Lacroix signalizes the interesting fact that the geological formations of the Guinea coast differ radically in their chemical composition from those of the nearby Isles of Los (p. 8). In the nephelinic syenites constituting Rouma (Crawford) Island, lavenite and astrophyllite are constant constituents, often present in as great quantity as ægyrite, all being distinguishable without the aid of the microscope; sometimes one and sometimes the other of these constituent minerals predominating. When these rocks contain arfvedsonite, occasionally accompanied by a little biotite, this amphibole forms crystals which may attain a length of several centimeters. In addition to the elements above noted, villiamite may also be found as well as fluorite and pyrochlore, both in microscopic quantities; more rarely eudialite is observable. To them may be added several secondary minerals. The author finds in the fact that the lâvenite is often formed after the feldspars a typical quality of these rocks, this constituent being usually a primitive constituent in rocks of this kind, although analogous conditions have been observed in nephelinic syenite from the Ord Range in Texas.

The syenites of the Isles of Los are divided by the author into the principal petrographic groups, whose close relation to one another is brought out by chemical examination. One of them, more alkaline and containing little or no lime or magnesia, is constituted by the syenites with ægyrite; the other, but a trifle more calciferous, includes the syenites with black amphibole and augite, and the alkaline monzonites where plagioclase exists.

The characteristics of these two groups and those of the minerals found in the syenites are very fully described. Among the minerals found in the first group are the following: feldspars, either sodium orthoclase (Rouma, Kassa), or microcline (Rouma, Robané); they especially abound in the pegmatites of Rouma; nepheline occasionally occurring in crystals five centimeters in length; sodalite, a light yellow shade of this mineral, abounds in the normal syenite of Rouma Island; in the pegmatites the soldalite occurs in crystals three centimeters long and of a light yellow, or a lavender blue color, greenish in places, ægyrite-acmite; the ægyrite sometimes approaches to acmite, while in some specimens of syenite from the northern part of Kassa Island only acmite is found; asfredsonite, oc-

casionally appearing in small acicular crystals with or without biotite, resembling those found in Norway and Greenland; låvenite, one of the most constant minerals of these rocks, and the most notable colored mineral of the rocks at Rofare, the small crystals being remarkably well defined, with intense polychroism; the author believes that these nephelinic syenites of the Isles of Los are those in which låvenite occurs most abundantly; rinkite; astrophyllite, constant in the syenite of Rouma Island, but only exceptionally found in that of Kassa Island; biotite, not often met with, sometimes perpendicularly impaled on the surface of crystals of magnetite; eudialyte, occasionally showing metamorphosis into catapleiite; villiamite, named by M. Lacroix after his faithful collaborator, M. Villiaume, a mineral characterized by an intense polychroism; fluorite, colorless, pink or light violet; pyrochlore, particularly abundant in the normal syenites of Rouma Island; galena; analcite, which the author regards as formed in a pneumolithic phase and not a product of decomposition; hydrophyllite; mesotype; losite and a number of other minerals. Many of these are present in the second group of syenites in addition to zircon, titanite, titanomagnetite, woehlerite, etc.

Chemical analyses of a number of specimens of the syenite are given and the examples shown in the plates are very fully elucidated. We have only been able to note a few of the more important data contained in this stately, valuable contribution to petrography by France's greatest petrographic geologist.

George F. Kunz

Ka hana kapa: The Making of Bark Cloth in Hawaii. By W. T. Brigham, A.M., Sc.D. Memoirs of the Bishop Memorial Museum of Polynesian Ethnology, III. Honolulu, Museum Press. 1911. 4to. Pp. 273; 48 plates and atlas of 26 colored plates.

It is well known to ethnologists that among the few living men having personal and scientific knowledge of the ethnology of the Hawaiian Islands, the director of the Bishop Museum stands unrivalled. During the period in which that museum has engaged in publication a succession of memoirs has proceeded from his pen, in which a vast amount of otherwise unwritten Polynesian lore is fortunately preserved. The present volume is devoted to the history and description of the bark cloth, tapa or kapa, of the Polynesians, a manufacture which reached its greatest perfection in Hawaii, and which, on the coming of the white man, with woven cloth and figured calico, deteriorated and soon practically ceased. Museum specimens alone preserve for us the actual material, on which Hawaiian art and fancy were so lavishly expended.

Dr. Brigham gives us first the history of its manufacture as described by the earliest voyagers, from Hawaii to Madagascar, the Philippines, and even Africa; then an account of the dyes and tools used; botanical descriptions and figures of most of the plants and trees from which the raw material was obtained; the uses of the finished product; the designs used in its ornamentation; a vocabulary of kapa terms, lists of the material studied in the various museums and in his own private collection, with numerous illustrations in the text; and finally an atlas of beautifully executed plates in color, reproducing the exact designs, with many black and white plates illustrating simpler variations, both from Hawaii and other regions where the art was practised.

Dr. Brigham and the trustees of the museum are to be congratulated on the appearance of this splendid monograph which preserves for posterity a wealth of information, much of which might, and indeed probably would, otherwise have been lost to the world in the course of a few years.

Wm. H. Dall

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTION

The Smithsonian Report for the year 1910 has just been published by the institution. Besides the report of the regents and the secretary, the volume contains, as usual, a "General Appendix" consisting this year of

thirty-four papers of popular interest on various branches of science, also biographies of a number of prominent scientific men who have recently died. Some of the papers are original, while others are reprinted from foreign and domestic scientific and technical periodicals. The following statement of the contents has been sent from the institution.

A review of modern progress in aviation is ably recorded by the late eminent aeronautical authority, Mr. Octave Chanute. His paper covers the principal advances made in aviation, beginning with the experiments of Hiram Maxim in 1894, and including Langley's experiments, 1896–1903, the author's own investigations, the work of the Wrights, Dumont, de Lagrange, Farman, Bleriot, Bell, Curtiss and others, bringing the subject down to the close of the year 1909. Altogether it is a most interesting review, illustrated with 19 plates and several text figures.

Mr. F. H. Newell, director of the Reclamation Service, sets forth the recent progress in the reclamation of the arid lands in the western states. The work of reclamation includes all the western states and territories, where nearly 10,000 families are being supplied with water. Through this great undertaking, the waste waters of the west are being conserved, destructive floods prevented, apparently valueless lands converted into productive farms, and thousands of families settled in newly opened territory where they are maintaining homes on reclaimed land. Besides engineering with its business and financial problems, the article deals with many other subjects, such as the character of settlers, the size of farms, crops, etc., and the individual projects which together furnish water for about 1,000,000 acres, nearly one half of which is already settled.

A kindred topic is the great electric power plant at Keokuk, Iowa, with its 4,278-foot concrete dam across the Mississippi River between Keokuk, Iowa, and Hamilton, Ill. This subject is treated by Mr. Chester M. Clark, in a well-illustrated article entitled, "Electric Power from the Mississippi River." The paper shows the development of the largest single hydro-electric plant in existence, through the construction of what is undoubtedly the greatest bank-to-bank dam in the world.

Under the heading of physics, Dr. T. Thorne Baker has written an account of experiments and researches in the telegraphy of photographs, transmitted by both the wire and the wireless systems; Mr. Jean Becquerel, professor at the Museum of Natural History of Paris, has permitted the translation of his valuable paper on "Modern Ideas on the Constitution of Matter," comparing the old theories of matter with the newer ones recently confirmed by experiments; and Professor R. A. Millikan has abridged his treatise on "The Isolation of an Ion," which deals with the exact measurement of an elemental electrical charge and several analogous problems.

On the testing of explosives, Dr. Charles E. Munroe, professor of chemistry at George Washington University, and a well-known authority on explosives, has written an interesting paper on the "Modern Developments in Methods of Testing Explosives."

Charles G. Abbot, director of the Astrophysical Observatory of the Smithsonian Institution, contributes an article on the recently developed subject of astrophysics, which is a study of celestial physics, but pertains principally to the heat and other physical properties of the sun. The paper relates to "The Solar Constant of Radiation," a topic on which Mr. Abbot is well informed, having pursued studies in that direction for nearly sixteen years, at the Smithsonian observatory in Washington, and on Mount Whitney and Mount Wilson, California. In this article the author deals with the problem of measuring the amount of solar heat received by the earth and that lost in transit to it, and the reader finds himself amazed at the obvious facts and reasonable possibilities depending upon the heat from the sun. The subject of astrophysics is further treated by Messrs. Curtiss, Deslandres and Bosler, in three timely articles.

Under the title "What is Terra Firma?" Mr. Bailey Willis, of the U. S. Geological Survey, attacks the old, yet modern, problem of the construction and balance of our globe,

in a review of current research in what is known as "isostasy." In the discussion of this puzzling question, Mr. Willis advances the theory that the foundation of all the continents is composed of solid rock which is self-crushed to a depth of about 120 kilometers, but rendered sufficiently rigid by pressure to maintain its form during prolonged geologic periods with but slight change. In spite of stresses occasioned by erosion of continental reliefs, this mass is capable of movements sometimes resulting in the gradual elevation of continents and the more vigorous uplifting of mountains, through which isostatic equilibrium is restored.

In line with the construction and condition of the globe, another author, Professor Thomas Chrowder Chamberlin, brings up the further vital question, "The Future Habitability of the Earth," in an article in which he reviews the past, and considers the future, of the world as a dwelling place for the human race. Many branches of science enter into the discussion, but upon geology, physics, chemistry, astronomy and astrophysics rests the burden of the arguments. Mr. Chamberlin thinks that the earth will remain habitable for tens of millions of years, but concedes that the close approach of a celestial body to the sun would probably result in the disruption of the solar system and bring disaster to the earth. He further states, in regard to the future possibilities of scientific research, that "when moral purpose and research come to be the preeminent characteristics of our race by voluntary adoption and by the selective action of the survival of the fittest, and when these most potent attributes join in an unflagging endeavor to compass the highest development and the greatest perpetuity of the race, the true era of humanity will really have been begun."

Several papers come under the head of botany, among them an interesting sketch of the sacred ear-flower of the Aztecs, a plant whose identity has been a mystery for years and only recently rediscovered by the author, Mr. W. E. Safford, of the Bureau of Plant Industry. This little flower, resembling the human ear, has a remarkable history and dates back to the early explorations of Mexico. It was first described in 1569, by Padre Bernardino de Sahagun, who states that it was much used owing to its delicious fragrance and its flavor when used as a spice. Despite the formidable name, Xochinacaztli, which it bears, the author suggests its cultivation on account of its unusual fragrance and pleasant spicy flavor. Mr. Henry S. Graves, chief of the Forest Service, contributes a well-illustrated and original article on forest preservation, in which he carefully considers all points in the great problem, making many things clear which have long been obscure.

Those interested in medical research and allied subjects will find matter of concern in the following papers: "Manifested Life of Tissues Outside of the Organism," by Alexis Carrel and Montrose T. Burrows; "Epidemiology of Tuberculosis," by Robert Koch; "The Significance of the Pulse Rate in Vertebrate Animals," by Florence Buchanan, D.Sc., and "Sanitation on Farms," by Allen W. Freeman, M.D.

A comprehensive paper on the contemporary Slav peoples, from a geographical and statistical point of view, by Ludor Niederle, of the Bohemian University of Prague, which has been translated from the Slavic language into English, furnishes new information on the history and distribution of these peoples. Dr. J. Walter Fewkes, of the Bureau of American Ethnology, contributes a brief review of his recent work and investigations in cave dwellings, both at home and abroad. This paper is entitled "The Cave Dwellings of the Old and New World."

The Report also contains biographies of Melville Weston Fuller, Sir Wm. Huggins and Alexander Agassiz, together with papers on several other subjects treated by competent authors, many of whom are world-wide authorities.

SPECIAL ARTICLES

CESTODE CELLS IN VITRO

THE desirability of throwing any light whatsoever upon the question of the character of

cell-division in cestode cells prompted me to attempt to apply the method of Harrison[1] in growing neurones, to cultures of cells from the tape-worms which are available from the spiral valve of the dog-fish, sand-shark, the cystic duct of the squeteague, etc. Inasmuch as sand-sharks were obtained only infrequently during the summer of 1911 at the Marine Biological Laboratory, Woods Hole, Mass., I was forced to depend upon the small *Calliobothrium* of the dog-fish, rather than upon the larger and more desirable *Crossobothrium* of the sand-shark. The form in the squeteague was not obtained in sufficient numbers to be of much use in the experiments.

I was directly led to the attempt of growing the isolated cells of the tape-worm from an examination which Dr. Frederic M. Hanes and Dr. R. A. Lambert kindly permitted me to make, of a series of their preparations of mouse sarcoma cells growing *in vitro* at the College of Physicians and Surgeons, New York. The marked success which they experienced[2] along this line, where the cells grew out from the small pieces of tissue from the living mouse and exhibited amœboid locomotion, absorption of granules of carmin, presence of mitosis, etc., seemed possible in other material.

The method which was used in the present set of experiments was as follows: Slides with depressions and their covers were sterilized in a hot-air oven at 200° C. for ten minutes. Where the plasma of the blood of the dog-fish or sand-shark was used, it was centrifuged after its drainage from the caudal artery under aseptic conditions (canula sterilized in olive oil at boiling) in paraffin lined tubes surrounded with freezing mixture and the supernatant plasma was pipetted into cooled tubes which were kept in an ice box until used. The precautions taken to insure sterility were of course aimed at keeping the plasma as free from bacterial decomposition as possible and thus offer to the cells of the tape-worm as nearly isotonic a medium for growth as practicable. If *Crossobothrium* was used as material, the blood of the sand-shark was used; if *Calliobothrium*, the dog-fish blood.

The tape-worms were invariably taken from a fish which had just been killed. They were washed off in sterile sea-water, with several changes and finally teased into small bits of groups of cells which were then transferred to a drop of serum laid upon a cover-glass with a platinum loop. The cover was then mounted in vaseline over the depression. In case *intra vitam* stains were used, these were introduced at once before the preparation was sealed. Inasmuch as I was dealing with a poikilothermous animal and not with a constant temperature, warm-blodded one, as in the work of Harrison, Burrows,[3] Lambert and Hanes *et al.*, it was not necessary to keep the slides in a thermostat. The temperature, however, varied only from about 17° C. to 23° C.

The cells prepared in this manner began to migrate from the mass within twelve hours and were to be found at the end of that period, or earlier, in some cases, distributed over the whole of the culture medium. I could not observe any true amœboid motion, as evidenced by the formation of pseudopodia and the streaming of granules, but there could be no other factor operating except the locomotion of the cells as far as I could determine. It must be understood that the cells are very small, and exhibit a marked degree of refraction, as is the case with all of the cestodes and even if blunt pseudopodia were formed, they would be observed only under the most favorable conditions, while probably protoplasmic streaming would be impossible to see. Moreover, when the plasma of *Limulus* was used, this distinction of cells was not observed, owing probably to the toxic action of the copper content of this peculiar blood.

Saline solutions of various content and pure sea-water were also used as media and in

[1] Harrison, R. G., 1910, *Journ. Exper. Zool.*, 9: 787.

[2] Lambert and Hanes, 1911, *Journ. Am. Med. Assoc.*, three communications.

[3] Burrows, M. T., 1910, *Journ. Am. Med. Assoc.*, p. 2057.

the latter, excellent results were obtained[4] as far as the living of the cells is concerned, but the unfortunate condition arose invariably that a large spirochæte *Spirochæte balbanii*, perhaps, grew in such numbers that the cells were soon covered with their growths and disintegration ensued. All attempts at freeing the medium from this animal, such as the use of $HgCl_2$ in various dilutions with the cestode before the tissue was teased were of no avail and the experiments in this direction were abandoned.

Difficulty was experienced in regard to the invasion of bacteria and spirochætes into the plasma mounts, but their growth for some reason was not as pronounced as with sea-water and indeed in many cases, no bacteria or spirochætes were found after ten days time. Therefore the plasma method was used throughout the experiments.

It was expected that the cells, which could be made to live in apparently good condition for several weeks in the plasma medium would undergo the process of fission and during the earlier stages of the study, I was convinced that I was observing such a phenomenon, but I finally was driven to the conclusion that what I saw was in no case cell division, but rather an association of the cells in twos which resembled a cell undergoing reproduction. I am under the impression that the cells which are cultured in this way do not undergo cell-division at all. I made charts of the slides which I had under observation for a week at a time and checked the behavior of all of the cells in each slide with camera lucida drawings, comparing those made one day with those made on the day previous. If any increase in number of the cells had occurred, I should have noticed it, of course.

In order that the cells may be stained for nuclear contents, it was necessary to take down the preparation and float the cover upon a saline solution for an hour so that the fibrin should dialyze out and I am under obligation to Professor Harrison for this technique, which is quite necessary, for otherwise the fibrin takes the nuclear stain to such a degree that the cells of the cestode become indistinguishable. Heidenhain's iron-hematoxlin, bismarck brown (used as an intra-vitam stain, as well as for fixed preparations), Ehrlich's hematoxylin, safranin and other stains were used, but all of them gave consistent results to show that cell-division was not taking place. The preparations were in some cases dried in the air or over a flame and mounted directly after staining. In other cases, the covers were inverted over osmic fumes and then passed through the alcohols into balsam.

Typical resting nuclei were seen in all of the preparations, but no indication of cell-division could be determined. It may be that cell-division occurs in rhythms as indeed is the case in *Crossobothrium* according to the results of W. C. Curtis and it may be that the period over which these present experiments extended did not cover the fission period. They were begun July 5 and extended to August 15.

In regard to the matter of regions in the cestode where fission is more likely to occur, such as the region immediately posterior to the scolex, in the "growth regions" of *Crossobothrium*, described by Curtis and in the maturing sex products, it may be said that all of these regions were examined by the methods described in this communication. No difference could be determined between the cells from one region and those from another.

While the results were unsatisfactory as far as the end desired is concerned and while they are negative throughout, it seems to me that the method may be applied to more favorable material where the character of cell-division is in question. The unmistakable presence of mitosis in the sarcoma tissue investigated by Lambert and Hanes, where amitosis has been so frequently described, is an instance in point. The "amitosis" of the follicle cells of insects is desirable and ever available material for such an investigation.

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November 1, 1911

[4] Compare Lewis and Lewis, 1911, *Anatomical Record*, 5: 277.